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LATIN AMERICA — CIVILIZATION OF LATIN AMERICA

KEY TO PRONUNCIATION.

ä	far, father
ā	fate, hate
a or ă	at, fat
ã	air, care
ạ	ado, sofa
â	all, fall
ch	choose, church
ē	eel, we
e or ĕ	bed, end
ė	her, over: also Fr. *e*, as in *de*; *eu*, as in *neuf*; and *oeu*, as in *boeuf*, *coeur*; Ger. *ö* (or *oe*), as in *ökonomie*.
ẹ	befall, elope
ẽ	agent, trident
ff	off, trough
g	gas, get
gw	anguish, guava
h	hat, hot
h or ʜ	Ger. *ch*, as in *nicht*, *wacht*
hw	what
ī	file, ice
i or ĭ	him, it
i	between e and i, mostly in Oriental final syllables, as, Ferid-ud-din
j	gem, genius
kw	quaint, quite
ṅ	Fr. nasal *m* or *n*, as in *embonpoint*, *Jean*, *temps*

ñ	Span. *ñ*, as in *cañon* (căn′yŏn), *piñon* (pēn′yŏn)
ng	mingle, singing
nk	bank, ink
ō	no, open
o or ŏ	not, on
ô	corn, nor
ȯ	atom, symbol
ọ	book, look
oi	oil, soil; also Ger. *eu*, as in *beutel*
ö or oo	fool, rule
ou or ow	allow, bowsprit
s	satisfy, sauce
sh	show, sure
th	thick, thin
ᵺ	father, thither
ū	mute, use
u or ŭ	but, us
u̇	pull, put
ü	between u and e, as in Fr. *sur*, Ger. *Müller*
v	of, very
y	(consonantal) yes, young
z	pleasant, rose
zh	azure, pleasure
′(prime), **′**(secondary)	accents, to indicate syllabic stress

ENCYCLOPEDIA AMERICANA

L

LATIN AMERICA, a general term given to the countries in South and Central America; especially those whose inhabitants come of Latin linguistic stock. These include inhabitants of Mexico and certain islands of the West Indies. The term HISPANIC AMERICA has also come into use, embracing both the Portuguese-American inhabitants of Brazil and the Spanish-American inhabitants of other countries of Central and South America, as descendants of natives of the Iberian Peninsula, which under Roman domination was called, as a whole, Hispania. From this point of view the Hispanic Society of America, New York City, the periodicals *Hispania* and *Hispanic American Historical Review*, all three deal with matters both Portuguese- and Spanish-American. Special information will be found in this section under the following heads:

1. General Characteristics.
2. Civilization of Latin America.
3. Education in Latin America.
4. Latin American Literature.
5. Latin America and the World War.
6. Transportation and Communication in Latin America.
7. Industrial Development and Commercial Products of Latin America.
8. Mineral Industry in Latin America.
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10. Cattle and Meat Industry in Latin America.
11. Hides and Leather in Latin America.
12. Coffey Industry in Latin America.
13. Fruit Trade of Latin America.
14. Rice Production in Latin America.
15. Rubber Production in Latin America.
16. Sugar Industry in Latin America.
17. Tobacco Industry in Latin America.
18. Wool Industry in Latin America.

1. GENERAL CHARACTERISTICS.

Latin America distinguishes as a group 20 American republics, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Salvador, Uruguay and Venezuela. In a still larger sense, but less accurately, as a general term it designates all of the central and southern portions of the New World, continental and insular as well, between the United States and Cape Horn. The total area of the 20 Latin American republics is about 8,150,000 to 8,200,000 square miles and the aggregate population of the same countries not less than 75,000,000. In each the language of the ruling class is Spanish, except in Brazil, where it is Portuguese, and in Haiti, where it is French or a patois called «creole.» But in the central regions of the Western Hemisphere are about 205,000 or 206,000 square miles with 3,190,000 to 3,200,000 inhabitants not included in any of the Latin American republics. They are held as dependencies by Great Britain, Holland, France or the United States; and to denominate these dependencies «Latin American» would be misleading.

A few facts may serve to supplement descriptions in the articles devoted to South America, Central America, Panama, Mexico and the West Indies; to each of the abovementioned republics, and to their political subdivisions.

Climate.— Readings of the thermometer, as set down in notes of travel in Latin America, are: At Montevideo, Uruguay, 18 June, 54° F. at 11 A.M.; Buenos Aires, Argentina, 4 July, 52° F. at 3 P.M. But the average of these two, namely, 53° F., was recorded on the west coast of South America as the lowest figure the mercury reached during the cold season at Lima — which lies so much nearer than do Buenos Aires and Montevideo to the equator that its range of temperatures would be decidedly higher were it not for the influence of the cold Humboldt current. In the article CHILE reference at greater length is made to this current, which is a truly beneficent river of the ocean, constantly tempering and stabilizing the climate along the Pacific coast, flowing northward and then northwestward along that coast until headlands below the equatorial line throw it straight out to sea, to cool one side of the Galapagos Islands. That is one of the big facts about the climate among others in the same field.

At the confluence of the Paraguay and Alto Paraná rivers, 25 July, the thermometer showed 80° F. in the shade at 10 A.M., and about noon of the same day on the Paraguay River, 92° F. in the shade; at Asunción, Paraguay, 27 July, 84° F. in the shade; in the same city, 28 July, 78° F. at 9 A.M. The circumstance that Asunción is built on a hill counts for much. Comparing these observations, made in regions remote from the ocean, with observations at moderate altitudes above the Atlantic coast, a striking difference is noticed immediately. Thus, on the road from the Brazilian port of Santos to São Paulo, 14 August, the thermometer showed only 62° F. at 2 P.M., and in the city of São Paulo, 15 August, 61° F. as the average of the forenoon. At Rio de Janeiro (nearly at sea-level), 19 August, we find 72° F. in the afternoon, but only 67° F. at 7–8 A.M., 20 August; and, as the record for the warmest day of that «winter» season in Rio, 84° F. at 3-4 P.M. A short distance away, at Petropolis among the mountains, we note 63° F. at 7 A.M.; and at an elevation of 1,500 feet above Rio, in the tropical forest clothing the flanks of Corcovado, 29 August, 60° F. at 7 A.M. The fact thus illustrated is, simply, that regions sufficiently elevated to receive quite directly the cool and saturated ocean breezes have, even in these latitudes near the Tropic of Capricorn, a climate not given to extremes but favorable to man and vegetation alike. Again, near the Atlantic coast in lat. 1° 52′ S., long. 38° 45′ W. we read 84° F. at 11 A.M.; in lat. 1° 13′ N., long. 43° 51′ W., 86° F. at 12, noon, to 1 P.M.; in lat. 8° N., long. 53° 48′ W, 85° F. at 2 P.M. The highest temperatures (in the shade) observed at the equator near the Pacific or Atlantic coasts, either at sea or where the ocean influence controls — 85° or scarcely more than 86° F.— must be called quite moderate. (See comment on this subject in the article BRAZIL). In the corresponding regions north of the equator, near the Tropic of Cancer, we appreciate, or resent, most promptly the development of intolerable degrees of heat in regions that are enclosed and far from the sea. For example, we notice en route Oaxaca, Mexico, to Puebla, 14 March, 100° F. in the otherwise comfortable cars of a train running through a valley. It is necessary to remember that the Antillean regions (see CENTRAL AMERICA) look out, on one side at least, upon a comparatively restricted and nearly bisected American Mediterranean, not upon the ocean which plays the part we have mentioned all along the South American east coast; that the trade winds and the Gulf stream visit some portions of this interpolated continental area assiduously, but are as constantly deflected from other portions; and, partly for this reason, each subdivision of the vast, varied and most interesting Antillean region is the subject of a special study. (See the separate titles). Panama, occupying the narrow space between two oceanic elbows, has, as shown by observations in a sheltered building near the centre of the capital during the year, an equatorially limited range of temperatures — from 76° F. to 88° F. But places shut in, even parts of the city of Panama itself, because they lie nearly at sea-level, may have 100° F. thrust upon them when the air-currents from ocean to ocean are interrupted temporarily.

Climatic Values of Altitude.— Here again in Panama (and this is not less true of the Central American states) we find that even a moderate elevation mitigates the tropically oppressive conditions that are notorious in the lowlands. The importance of this consideration becomes apparent when we reflect that in much more than one-half of the entire land-area in the New World between the Tropics of Cancer and Capricorn nature assigns the control of temperatures to mere altitude or to the almost equally permanent influence of oceanic and aerial currents. But in the vast highlands of Latin America one learns by experience, if he has not learned through previous study, that the pure and rarefied air is bad for any weakness of the heart, and, even when there is no such weakness, produces what is commonly known as soroche (anoxæmia or mountain-sickness). It is worth while to note quite carefully the effects of the change from sea-level to these great altitudes, since the experience bears directly upon the question of the value of these uplands as regions where civilized men can live and work successfully. We observe, as first effects, that the skin becomes rather dry and the digestive processes are deranged — with consequent pains and penalties. We must add the following symptoms: lassitude, loss of appetite, aversion to all forms of physical effort and drowsiness. The heart finds its steady job a bit harder than usual, and one gets out of breath too quickly, the air seeming to supply the lungs with innutritious food. After a long voyage a traveler in vigorous health suffers to this extent — that is, slightly and for a few days at least — on making a rapid and radical change. But in a week or so these symptoms disappear, the traveler gets acclimated and should find no trouble in making any physical effort that the situation calls for. Quite the contrary, in fact. We enjoyed mountain-climbing, long walks, long and hard riding, at altitudes of about 12,000 feet for several weeks and ranging from 10,000 to 16,000 feet during two months. The impression we receive in regard to the people living in Andean towns (for example) situated at altitudes of 7,000 to 14,000 feet is that they, as a rule, with some exceptions of irregular lives, are not injured by the climate.

Naturally healthful regions are the following: 1. The extensive region south of a line drawn from ocean to ocean through the cities of Paysandú and Valparaiso, including all of southern Argentina and Chile. 2. The uplands of southeastern Brazil. 3. The Andean habitable districts, including many valleys and cuencas, at altitudes ranging from 6,000 to 12,000 feet. 4. In Venezuela, Central America and Mexico, the districts, often fertile and extensive, at altitudes ranging from 2,500 or 3,000 to 7,000 feet, more or less. 5. Portions of the West Indies receiving the full benefit of the trade winds and ocean currents. Unfortunately it is necessary to note the prevalence of such diseases as typhoid fever in cities and towns whose favorable situation in temperate uplands does not safeguard them against the consequences of neglecting sanitary regulations. The tropical conditions in the low-lying parts of Central America and the northwest coast of South America (to and including the Gulf of Guayaquil) are unfavorable to health chiefly because enormous deposits of alluvion and excessive rainfall offer ideal conditions for the propagation of disease-bearing insects. Yellow fever and malarial fevers have therefore long been regarded as endemic. Similar conditions are found in the great Amazon Valley and on the tropical Brazilian coast between the Atlantic and the highlands of the interior. Successful efforts to combat and control these fevers have been made at focal points — at Santos and Rio de Janeiro, at Panama, etc.— but much still remains to be done. Annual rainfall is most excessive in amount at Pernambuco and Iquitos in Brazil, at Greytown in Central America, and in the territory of Magellan, in southern Chile; it is least on the Peruvian littoral and in northern Chile (q.v.); it is as a rule moderate in the interior of Argentina. Dense fogs, called garúas, supply the place of rain (but only to a slight extent) in the arid west coast regions just mentioned. Ever since the discovery of the New World the fact has been observed that the most vigorous races gained their development in the extreme south (region number 1) and in the temperate or relatively cold uplands (regions 3 and 4). It is not less interesting to observe that the most progressive and vigorous element of which we have any record in the early history of Brazil had its home in region number 2. For the exceptionally fine and temperate climate of Uruguay, see the article devoted to that country.

Fauna and Flora.— The highlands of the northern and central portions of Mexico are included in the Nearctic Region and their fauna is classed with that of all temperate and Arctic North America; but naturalists, grouping together all other parts of Latin America, in the wider sense of that term, distinguish the group (thus composed of Central America and Panama, the Mexican lowlands, the West Indies and South America) as the Neotropical Region. A valuable study entitled 'A Zoölogical Expedition to South America,' by W. E. Agar (in Royal Philosophical Society of Glasgow Proceedings, Vol. XL, pp. 53-65, 1909), contains an expression of its author's opinion to the effect that the Neotropical is, of all those regions into which zoologists divided the world in accordance with their fauna, by far the most interesting. And this is true although only four families of the ungulates are represented: the pigs by the peccary, the cervidæ by a few species of deer, the camels by the llama, and finally there is the tapir; while the beasts which we may call characteristic of the country are such forms as the opossum, armadillo, ant-eater and sloth, all very lowly organized animals.

Our interest in this fauna is deepened when, at the suggestion of the same writer, we examine its history in past geological ages. «The past history of the mammals [in general, i.e., in all regions] shows us that, broadly speaking, most new forms arose in the North Polar regions (which we know were much warmer then than now) and spread thence southwards, exterminating to a large extent the more primitive earlier forms, and being sometimes ousted in their turn by new forms migrating southwards. Now, the primitive mammals which arose in the Northern Hemisphere seem to have reached South America, not across the Isthmus of Panama — for we known that the whole south portion of North America was submerged at this period — but probably by means of a land connection across the Atlantic with Africa. Whatever may have been the exact nature of this connection between South America and the other land-masses of the globe toward the end of the secondary geological epoch, it is certain that it was soon broken through and that South America was completely isolated during the whole of that period in which the most active evolution of mammalia was taking place in other parts of the world. The few low mammals which had reached South America before it became isolated evolved a very peculiar mammalian fauna, including such forms as the giant sloth or Megatherium, and Glyptodonts like gigantic armadillos, which, however, never reached a very high grade of development, such as the mammals in the more desperate struggle for existence that was going on in other parts of the world were attaining.» But finally a new path of approach to this completely isolated continent was constructed. During the end of the Miocene period the emergence of the Isthmus of Darien or Panama allowed the influx of more highly specialized forms from the Northern Hemisphere; and accordingly we find that fossiliferous beds dating from this period hold the remains of lions, the sabre-toothed tiger, dogs, bears, llama, deer, horses, tapirs and peccaries — animals that had been abundant in other parts of the globe for ages before, but had been unable to reach South America for the reason mentioned. These invaders «established themselves to a great extent at the expense of the old typical South American fauna. Remains of this original fauna, however, still survive in the opossum, armadillo, ant-eater and sloths, while the new forms, which are now far more abundant, both in numbers and species, include such forms as the deer, tapir, peccary, puma, jaguar, wildcats, dogs, etc.» Ex-President Roosevelt invites our attention particularly to the fact that South America has the most extensive and most varied avifauna of all the continents. The rhea, or American ostrich, and the fur seal were studied with true interest by Dr. John Augustine Zahm in Uruguay. For the distinctive fauna and flora of an important part of the west coast, see CHILE. On the other hand the countries of Central America, forming borderlands between the greater North and South, naturally show some results of the proximity of the former; nevertheless the influence of the latter has been in these respects so much the more potent that Central America is with good reason assigned to the Neotropical Region, as we have said above.

Near the heart of South America, the region called the Chaco is interpolated between the region of great forests and the sabanas and pampas — the last being poor in vegetation while the first is in the same respect almost beyond belief richly endowed: since in that vast Amazonian valley the vegetable kingdom long ago fairly conquered the animal kingdom by expelling or subordinating the most important terrestrial mammals. (Consult *Putnam's Magazine,* Vol. VII, pp. 194-199, New York, Oct. 1909-April 1910). Of course it is still impossible to say what addition will be made to recognized lists of plants by these equatorial South American forests: they have never been more than partially explored; a civilizing reconquest of the fertile areas they usurp has never been attempted systematically. Taken all together they make the Great Forest of the world, sharing primacy in the list of this world's natural features with the Andes, the greatest of mountain masses, and with the Amazon's wholly incomparable torrents. We mention here only a few of the best-known natives of widely separated parts of Latin America: Cinchona, maté (*Ilex paraguayensis*), coca, various rubber-producing forest growths, victoria regia, maize and *Agave americana* (both presumably Mexican), tobacco (a product of the islands of the West Indies), and potato, claimed as a native by both Chile and Peru. A very early association existed with the flora of the Eastern Hemisphere; a much more recent connection was established with the North American flora. (See above). Botanic geography will, we think, establish the facts that Latin America's most distinctive and distinguishing possession is its flora and that in this respect, even more — or much more — than in respect to its fauna, its claims will reward our attention; and although this is «by far the most interesting region» to the botanist as well as to the zoologist, we shall find both botanists and zoologists as one in asserting that the primitive geologic union of the South American continent with Africa and Australia explains many phenomena which could not be understood otherwise. Briefly, then, Latin American flora and fauna, both of surpassing interest, have indeed enjoyed independent development, yet in most ancient times they undoubtedly influenced and in turn were influenced by the flora and fauna of equatorial, tropical and sub-tropical regions of the Eastern Hemisphere.

Languages.— Interesting variations are observed in the Spanish, spoken and written, which, as we have said, is the language of the ruling classes in 18 of the republics. Thus, in Mexico its characteristics are those of the tongue of southern Spain, but in Costa Rica those of northern regions in the mother country; in distant Chile the Castilian linguistic standards are flouted (the substitution of *j* in place of *g* being a single example of literary and popular revolt), while Cuba has held fast to the good old Spanish linguistic traditions through all the years of political insurrections and armed rebellion. Ecuador, Colombia and Peru deserve their fame as, in this respect, conservative centres of an inherited culture, where the best usages are appreciated by writers and speakers. The literature of that great country, Brazil, in which Portuguese is spoken, seems to all loyal Brazilians a priceless treasure, even as the manuscript of the ‹Lusiad› seemed to Camões: they cherish their language in corresponding degree — somewhat too exclusively.

Governments of Latin America.— The Latin American countries are constitutionally either federal states, resembling most nearly in this respect the United States of America, or are unitary and centralized. The United States of Brazil, the United States of Mexico and the United States of Venezuela more obviously stand in the class first mentioned; Argentina's governmental plan embraces some of the features characterizing each class; the other countries (Republic of Bolivia, Republic of Colombia, etc.) in the main illustrate by their organization the growing unitarian or centralizing tendency: «Republic of Colombia» was formerly «United States of Colombia»; the variations are, however, so complex that we convey only an approximately correct idea of them when we say that the federal form of government in Latin America resembles that of the United States and the centralized that of France. The readers who wish to study this subject closely will find paragraphs on government and constitution in the articles devoted to these countries separately, with careful bibliographic reference to such special works as are available. Frequent constitutional changes are there recorded; but these must not be regarded as indications of weak vacillation. It is only fair to say that they are to a somewhat greater extent than we commonly realize paralleled in our own experience, particularly in the matter of State governments (consult Holcombe, A. N., ‹State Government in the United States,› pp. 119–120, New York 1916); that by the middle of the 19th century «the constitutions of most of the States of the United States had been revised or were in process of revision»; and that, «beginning in 1870, the constitutions of most of the leading States in the north outside of New England [and in the South after the overthrow of negro domination] were revised, the culmination of the movement being reached in New York in 1894.» Some of the most interesting constitutional changes in South America (for example, in Paraguay) were designed simply — and wisely — to prevent the recurrence of dictatorships and so to safeguard orderly development in the future. The dangers in that quarter have often been bravely met and will surely be overcome; their magnitude, and the importance of these phenomena in every study of this branch of our subject must be admitted.

But the people who possess the splendid central and southern regions in the New World have determined that whatever impedes true progress or conflicts with the stability of republican institutions shall have no place in the third great period of national development, which is at hand.

Marrion Wilcox.

2. CIVILIZATION OF LATIN AMERICA. Latin-American civilization from an Anglo-Saxon point of view may be found wanting in many respects, but the life and happiness of nations, the ideals and hopes of their peoples, their legislation and institutions, are not to be found ready made, but have to be worked out to meet peculiar wants, and in accordance with the racial, mental, moral, climatic and material resources and necessities of each.

Latin America must be dealt with as a whole if one wishes to cast a rapid glance at its civilization. Some of the 20 free and independent states which in their aggregate make up Latin America have developed more than others, and a few to a remarkable degree, but whether north or south of the Panama Canal, east or west, on the Atlantic or the Pacific, on the Caribbean or the Gulf of Mexico, the countries of Latin America sprang from the same race — the brave, hardy, adventurous, romantic and warlike Spanish and Portuguese conquerors, who fought their way through unknown territories, whether in quest of «El Dorado» or in warfare against whole nations of Indians, as in the case of Mexico and Peru, where the native Indians had a wonderful civilization of their own.

On the other hand, the men who founded the United States, the Pilgrims who first set foot on this new land of promise, and those who followed in the wake of the first settlers, came to the country already prepared, through years of training, to govern themselves. They came to the friendly shores of the New World in quest of freedom. They wanted a home in a new land not yet contaminated with the spirit of the Old World. They brought with them their creed, their habits of order and discipline, their experience in self-government, their love of freedom, their respect for the established principles of law. Hence from its inception Anglo-American civilization was built upon solid ground. Its subsequent development — the marvel of the last half of the 19th and of this 20th century — is due to the solidity of their institutions, their steadfastness of purpose, their practical view of life, and a territorial expanse where all the soils, all the wealth, all the climatic conditions of the cold, the temperate and the tropical zone can be found.

The discussion of Latin-American civilization is of vast importance, since it deals with the history and development of 20 republics lying beyond the Mexican border, and covering an aggregate area of about 8,200,000 square miles, with a total population of nearly 80.000,000, of whom 54,000,000 speak the Spanish language, 24,000,000 Portuguese in Brazil, and 2 000,000 French in Haiti. This general division brings us at once to deal, under the same classification, with peoples and civilizations springing from different sources,— Spanish, Portuguese and French. Even among the Spanish-speaking countries there are conditions, — depending on the province of origin of the first Spanish colonizers and settlers, who came mainly from Biscay, Andalusia, Castile, Aragon and Estremadura — which tend to establish slight differences and peculiarities just as the various States of the United States show dissimilarity due to the sources of their population.

Geographically, Latin America begins beyond the Rio Grande, with Mexico, at the southern boundary of which extends what is called Central America, consisting of Guatemala, Honduras, Salvador, Nicaragua and Costa Rica, the historic five Central American states; Panama, the gateway to the Pacific on the west and to the Caribbean and the Atlantic on the east; South America proper, embracing Venezuela on the Caribbean, Colombia on the sea and partly on the Pacific; Ecuador, Peru and Chile, bordering on the Pacific; Bolivia and Paraguay, inland states in the heart of South America; Argentina, Uruguay and Brazil on the Atlantic; and, lastly, Cuba, Haiti and the Dominican Republic, islands in the Caribbean Sea. Thus Latin America extends from the north temperate zone to Cape Horn, near the Antarctic Ocean, which means that all climatic conditions are found in that enormous area from the cool regions of northern Mexico to the tropical heat of the torrid zone and again to the cold lands of Patagonia. This is indeed a world of wealth where all the products of the globe can be successfully cultivated, where all races of mankind can live and thrive, because the Mexican and Central American cordilleras, and farther south the mighty Andean range, offer an unbroken chain of lofty peaks, wide valleys and extensive tablelands, affording all climates and zones, all kinds of soils and minerals, the only limitation to the development of these lands being human endurance. The water supply is plentiful in most parts of Mexico and the Central American republics, and there is nothing which can be compared to the hydrographic areas of northern and central South America, consisting of the Orinoco Basin with its 400 affluents, offering a total navigable length of about 4,000 miles; the mighty Amazon, having three times the volume of the Mississippi and navigable for over 2,000 miles, and the network of great rivers emptying into it; the Paraná and the river Plata, with twice the volume of the Mississippi, and a thousand other streams too numerous to mention in detail, but which can be found on any fairly good map, showing a feasible water route from the mouth of the Orinoco in Venezuela to the Amazon and the very heart of South America, and thence to the Paraná and finally down to the river Plata.

It is well known how Columbus discovered this New World which to-day bears the name of America (although the application of that name is quite restricted in this country to the United States)— what hardships that undaunted sailor and his followers had to endure, their sufferings, their hopes and their faith in some supernatural fate, a trait which is due in part to the influence of Moorish ancestors in Spain through the mingling of both races during the occupation wars which lasted over eight centuries. The discovery of America has a tinge of romance, such as inspires the soul of the adventurer and the buccaneer. It was a romance that began at the Rábida, grew in the presence and with the help of good Queen Isabella, developed into a mad desire for adventure at Palos, and ended with the planting of the Spanish standard on the shores of Guanahani, now called Watling's Island. From here Columbus went to what is to-day called Cuba, thence to Hispaniola — now divided into Haiti and Dominican Republic — and in this latter island founded the first white settlement in the New World. It is not necessary to follow Columbus' voyages or his adventures step by step, but the discovery of America is an epic worthy of the mettle of the great explorer and his men.

And so the civilization of what is called Latin America began with the first Spanish settlement, the first Indian blood shed by the greed of the white conqueror and the first attempt to Christianize the inhabitants of the new-found land. The inevitable features of conquest — war, treachery, destruction, fire, sword, deeds of valor but little known and endurance almost superhuman — marked along the trail of the discoverers the birth and first steps of the nations of the New World. And in the midst of this turmoil, bravely battling against unknown odds, the Spanish missionary fathers worked unceasingly, founding hamlets and towns, thus planting in the wilderness the seeds of many a large city to-day, building their temples of worship, going from place to place struggling with disease and hunger, teaching the Indians the Spanish language and with it their religious faith, and laying the foundation of what is known to-day as Latin America.

The second stage of Latin-American civilization began when the Crown of Spain finally took an active interest in its new possessions and men of a better class than the soldiery which landed with the discoverers and conquerors began to come to the New World, bringing their wives and daughters, and surrounding themselves with whatever comforts could be had in their new home. They were in many cases scions of noble families, who came either as viceroys, governors or in some other administrative capacity, or as «oidores,» or judges, and men of letters in general. There came also learned monks, and among these, philosophers, poets, musicians, painters and skilled artisans. Hence some of the oldest descriptions and chronicles of Latin America are in verse or in choice prose, either in Spanish or in Latin, and we find in some of the oldest cities in Spanish America wonderful examples of wood carving, either in churches or in old houses, beautiful specimens of the gold and silversmith's art, some fine paintings, and unexcelled samples of the art of illuminating books, particularly missals.

The scholars, either members of the religious orders or laymen, began to gather books imported from Europe, and so our libraries were started, mainly in the convents. With this feature of civilization the necessity of educating the children of the Spaniards and the Indians became more pressing, and private schools and seminaries were established, as a first step toward the foundation of universities. Both in Mexico and in Peru schools were founded by order of the Crown of Spain for the education of the Indians, where they learned not only reading and writing, but the manual arts as well.

Latin Americans point with natural pride to the fact that the first university founded in the New World was that of Santo Tomás de Aquino at Santo Domingo, in 1538. This university is no longer in existence, but there still exists that of San Marcos at Lima, Peru, founded in 1551; the University of Mexico, established in 1553 and refounded in 1910; the University of Córdoba, in Argentina, dating from 1613; that of Sucre in Bolivia, founded in 1623, or 13 years before Harvard, which dates from 1636, and that of Cuzco, in Peru, established in 1693, or eight years earlier than Yale, which was founded in 1701. The University of Caracas, in Venezuela, dates from 1721, and that of Habana, Cuba, from 1728, the other universities founded before the 19th century being that of Santiago, Chile, in 1743, and the University of Quito, Ecuador, in 1787.

The great agent of civilization and progress, the printing press, has been known in Latin America since 1536, when the first printing outfit was introduced into Mexico and the first book printed in the New World, a plea of Father Las Casas for a better life. Cartagena, Colombia, is said to have been the second city of America to have a printing press, in 1560 or 1562, but Peru seems to hold the record for the first book printed in South America, about 1584, and La Paz, Bolivia, had a printing establishment about 1610. There were also a press and other printing paraphernalia at the Jesuit missions of Paraguay, about the first decade of the 17th century. The first work in Bogotá was printed about 1739; Ecuador printed its first book in 1760 and Venezuela in 1764, while the earliest production of the Chilean press bears the date of 1776; and there was a printing outfit in Córdoba, Argentine, in 1767. With the foundation of universities and schools and more frequent communication with Spain and other European countries of Latin origin, and the printing of books and newspapers in the New World, the desire for learning was developed and a new field was opened to intellectual culture.

The dissatisfaction of the colonies with the exactions and abuses of the viceroys, captains-general and other officials representing the Crown of Spain, jealousies between the «creoles,» or children of Spanish parents born in America, and the «peninsulars,» or native Spaniards, commercial preference and social distinctions and other petty annoyances born of the arrogance of the Spaniards on the one hand, and the proud nature of the creoles on the other, were the smouldering embers which, fanned by the success of the American Revolution and the storm of the French Revolution, set on fire the Spaniard colonies at the end of the 18th and the beginning of the 19th century. The majority of the Spanish-American countries attained their independence between 1804 and 1825, and their struggles for freedom, while encouraged by the example of the United States, were inspired by French ideals. The heroes of the bloody but romantic French Revolution, their fiery speeches and fearlessness, their proclamation of the republic and the rights of man; the echoes of the Boston Tea Party, the exploits of the spirit of '76, the commanding and serene figure of Washington, the adoption of the American Constitution, the utterances of the grave thinkers and inspired orators of the Revolutionary period — all these dazzling examples of patriotism appealed to the Spanish-American colonists, and one by one the colonies began their fight for independence. The executions and ignominy which were the lot of the first patriots who forfeited their lives for the cause of independence, instead of discouraging the leaders, made them more aggressive, and they resolved to gain the day at all hazards.

On the most brilliant pages of the history of Latin America are written, among the names of other heroes, those of Miranda of Venezuela, the precursor of South American independence; Bolívar, who has been called the Washington of South America, a born leader, the liberator and father of Venezuela, his native country, and of Colombia, Ecuador, Peru and Bolivia; Sucre, also a Venezuelan, more like Washington than was Bolívar; San Martín, the great general of Argentina, the brave and heroic liberator of the southern half of South America; Artigas of Uruguay, a man of sterling qualities; O'Higgins, the great Chilean hero; Tiradentes, the forerunner of Brazilian independence; Morelos and Hidalgo in Mexico, both Catholic priests, and both martyrs to the cause of independence; and scores of others from each country whose names would be meaningless except to those well acquainted with the history of South America.

Once free from colonial bondage, the new republics, whose political constitutions in the main are based on that of the United States, had to deal with fresh problems arising from changed conditions. The new political entities commenced their independent life heavily handicapped, on the one hand by their economic condition after a period of protracted wars, and on the other hand by a scarcity of population. The unbounded productiveness of Latin America, coupled with the modest wants of the masses, has been the main cause of the slow development of most of these countries as manufacturing centres, their chief means of support being agricultural and allied industries and mining. The evolution out of all this chaos has been more rapid in some countries than in others, due to special conditions, among which the principal ones are geographic and topographic position and predominance of the white man.

The leading classes, owners of black slaves and landlords to the Indian tenantry, lived for the most part in relative ease after the war of independence. Those who did not seek in the army a field for their activities or inclinations devoted themselves to intellectual and scientific pursuits, either in civil life or in the service of the Church. Some went abroad, to France or Spain preferably, to acquire a general education or to perfect that received at home and to see the world, and on their return bringing new ideas which were eventually adopted and modified as necessity demanded. With the progress of the 19th century Latin America also advanced.

Intellectually, there is no difference between the Latin-Americans and the Anglo-Americans. The literature of Latin America (q.v.) is as rich and valuable as that of any country, yet it is hardly known — not to say entirely unknown — in the United States except by a handful of men who have devoted their time to the study of the Spanish language. It is only during the last few years that a desire to learn Spanish has made itself felt in the United States, and it is most gratifying to note the number of persons now able to read and understand the language and their growing familiarity with things Latin-American. On the other hand, the study of modern languages is compulsory in all of the universities and colleges of Latin America, and absolutely necessary to obtain certain academic degrees. French was for a long time the language chosen by the majority of the students, hence the influence of French literature and French thought in Latin America. German was taken up by many, more as a commercial tongue than otherwise. English was preferred by others, rather as an accomplishment than as a language of immediate practical use, but now it has taken, in many cases, the place of German. These two languages have followed the trend of trade, but English is becoming more useful every day in view of the increased relations of Latin America with the United States, in all spheres of human activity.

The problem of education has always commanded the earnest attention of all the Latin-American governments, to the extent of having made primary education not only free but compulsory. So far as higher education is concerned — that is, all grades above primary — there are institutions, either public or private, or both, for secondary and superior education, normal schools, schools of mines, agricultural and manual training, technological institutes, colleges, universities, conservatories of music, academies of painting and sculpture, national or public libraries, museums, etc.— in short, all kinds of institutions devoted to the moral and intellectual uplift of the people.

In each of the Latin-American countries there is a system of scholarships which serves as a practical means of promoting interest in education. This system provides for supporting abroad for a certain length of time such students and graduates as have won honors, who are sent to Europe and in some cases to the United States, to perfect their education and bring home the latest and most approved methods. Since the present war began students come to the United States who formerly would have gone to Europe to take a post-graduate course in some science or profession. Others are in this country studying and investigating school methods and appliances. At present there are over 1,300 such students in the United States.

With better means of communication and a desire to expand their trade with Latin America, United States merchants and travelers are visiting intelligently the Latin-American countries, and men of science and learning have, during the last few years, turned their eyes toward that continent, bringing to light the wonders of past ages buried by the sands of Time, and doing justice to a civilization then little known, and only by a few. No better proof of the fact that Latin-American civilization is worthy of note could be had than the desire to exchange professors and students between certain universities of the United States and those of the leading South American countries, as well as the acquisition, generally by purchase, of important private libraries of Latin America, containing invaluable works dealing with the history, progress and higher development of those countries.

Latin Americans have done much toward the progress of the world both intellectually and materially. Civilization may be divided into two great branches from which others spring: development of the intellectual forces of mankind and development of the material resources for the benefit of society. Under the first head — as has been shown in the preceding paragraphs — there are found educational institutions to train and perfect the mind, which have existed in Latin America for centuries, and the result of this training has been great jurists, historians, orators, physicians, painters, sculptors, poets, musicians, playwrights and others too numerous to mention when dealing with 20 countries, but whose works might fill a great library. A passing mention has already been made of the standing of Latin-American writers. There are painters and sculptors of renown, whose works have been admired, rewarded and commended in the leading art centres of the world. In all these countries there are art schools from which the students go preferably to Italy or France, most frequently pensioned by the government, to perfect themselves. There are musicians wedded to their art and a credit to their country and themselves; and composers, singers and players educated in their own conservatories or schools. There are theatres and opera-houses not surpassed by any others in the United States or Europe, and the governments of many, if not all, of the Latin-American countries contribute to the musical education of the people by subsidizing opera troupes every season or so, paying large sums to obtain the best singers. Many a celebrity who has come to New York has commenced his career in Latin America.

There is another phase of Latin-American civilization showing in an unquestionable manner a natural tendency toward the establishment of higher ideals — those ideals that are to-day being proclaimed by men of good will of all nations. I refer to arbitration, recourse to which is the highest form of culture among peoples. Arbitration is not new with the Latin-American peoples. It is one of the basic principles of their social structure, since it rests on the civil law of Rome, which provides for arbitration as one of the ordinary and usual means of settling differences between man and man. The principle of world arbitration was first proclaimed by Gen. Simón Bolivar, who was the originator of the idea of holding the first Congress of Nations of America at Panama in 1826, for the purpose, among others, of adopting arbitration as a principle of American — that is to say, Pan-American — policy.

In recent years Latin America has had recourse to arbitration and direct negotiations partaking often of the nature of arbitration, more frequently than all the rest of the world. Latin-American wars have been civil wars for a political principle, and these mainly in countries where the military element predominates. They have never engaged in wars of conquest. In their international difficulties arbitration has always been the keynote of negotiations. It is a remarkable fact that in the history of the Latin-American republics, since they became independent from the mother country over 100 years ago, they have had among themselves only two international wars, and these could indeed be classed as national, since they were fought among members of their own family of nations. But these wars were not fought for territorial expansion, nor in the spirit of conquest, although territory may have been gained as an indemnity. These are the Paraguayan war against Brazil, Uruguay and Argentina, 1865–70, and the war of Chile against Bolivia and Peru, 1879–84. On the other hand, who, looking at the map of Europe before this war, would recognize it as the same Europe of half a century ago? With one or two exceptions — the Iberian and Scandinavian peninsulas and the British Isles — there is not a single country that has not been remade at the cost of numberless lives.

All boundary disputes — and they have been many — have been or are being settled by arbitration. Could any better proof be offered of the advancement of peoples who, while springing directly from a race of warriors, are not afraid to work toward the ends of peace?

Another proof of this spirit of progress is the maintenance in the city of Washington, by all the countries of the American hemisphere, of a unique organization called the Pan-American Union, the living embodiment of the idea which created the International Union of American Republics as a result of the first Pan American Conference held in Washington in 1889–90 at the invitation of that great American statesman, James G. Blaine. The Pan-American Union represents the spirit of progress, the desire for a better understanding, the necessity for stronger ties of friendship, felt among the republics of the three Americas, by making them known to one another, by bringing to the attention of the people of the United States the opportunities offered by the Latin-American countries, their civilization, their onward march toward prosperity, united in a single purpose of material and moral advancement.

There is another aspect of the civilization of the Latin-American republics which deserves more than passing attention. It is their political life as members of the Pan-American fraternity of independent nations. Their first step toward higher ideals was their declaration of independence and their assumption of the duties and exercises of the rights of sovereign states. The transition from colonial dependencies to self-governing nations was fraught with difficulties unknown to the citizens of the original 13 states of the North American Union, resulting from different conditions, due in the main to the spirit that inspired their complete emancipation. The original 13 States separated from England principally for practical reasons, while the Spanish-American countries had to contend with an economic as well as a political problem.

After a period of evolution — or of successive revolutions, as some would say — during which the several antagonistic interests were undergoing a process of amalgamation, or better still, clarification, there now exist, in the majority of Latin-American countries, stable governments whose sole aim is to maintain above reproach the moral as well as the economic credit of their respective nations, so as to attract foreign capital and energy, which will stimulate the development of home industries, and ensure peace, prosperity and happiness to its citizens. Some Latin-American republics have been less fortunate, but every disturbance, all civil strife, should be construed, in fairness, as a misdirected effort toward the attainment of a goal dreamed of and desired by all. Public education, foreign commerce, improved means of communication, greater development of the natural wealth of these countries, are factors which have contributed and are constantly contributing to the establishment of a peaceful era which will eventually become normal and stable.

As to the material phase of Latin-American civilization, communication with the other countries of the world at the beginning of the World War was represented by over 50 steamship lines plying between European ports and those of Latin America, and about 25 lines running from the United States to the Atlantic, Caribbean and west coast ports of Latin America. The combined railway mileage from Mexico down to Chile and Argentina, including the island countries of Cuba, Haiti and the Dominican Republic, is estimated at over 68,000 miles, Argentina leading with over 22,000 miles; next comes Mexico with over 15,000 miles; Brazil follows with about 14,600 miles; Chile, nearly 6,000; Cuba, nearly 2,500, and the other republics in lesser proportion. There is not one single country, however, that is not included in this total mileage. It may seem strange that in an area of about 8,200,000 square miles there should be only 68,000 miles of railway, but if one stops a moment to consider the enormous barrier extending along the west coast of South America, formed by the mighty range of the Andes Mountains, which made direct communication between the cities of the Atlantic and Pacific coasts very difficult, and the scarcity of population which creates demands and makes traffic profitable, one will understand why the railways of Latin America have not advanced faster. But even under these circumstances, not a day passes but some work is done toward the extension of that railway mileage.

Another phase of civilization and progress is the foreign commerce of a country. The progress made by Latin America in its commercial relations with the world at large and the United States, especially, shows that there is a great consumption of all such articles as are considered necessary to civilization. Latin America is not a manufacturing continent; it mainly produces for export agricultural products such as sugar, coffee, rubber, tobacco, cacao or cocoa, cotton, etc., hides and other raw materials, mining products such as silver, gold, tin, copper, iron, bismuth, saltpeter, etc., and a few gems. Its main imports are machinery of all kinds, hardware, cotton and other fabrics, foodstuffs, carriages and automobiles, railway material, electrical appliances and other similar products of industry necessary to the cultivation of the land, the improvement of roads and cities, and the comfort of the inhabitants.

There is not a city of any importance in Latin America where either artificial illuminating gas or electric light is unknown. Telegraph and telephone wires stretch all over Latin America, uniting cities and towns, over the wilds and across the mountains, bridging mighty rivers, connecting neighboring countries and linking their shores with the rest of the civilized world. Not an event of any importance takes place in Europe, Asia, Africa or the United States which the submarine cable does not bring to the Latin-American press, to be made public either in the form of bulletins or in "extras," according to the importance of the event, while nearly every Latin-American country has its wireless telegraph system. Electric cars are fast replacing the older and slower methods of transportation within the cities and extending their usefulness to carrying passengers to suburban villas, small towns or country places of amusement, and Buenos Aires, the largest Latin-American capital, has a subway in operation.

A charge frequently made against Latin-Americans is that they are a race of dreamers. There is some truth in this. Latin-Americans have inherited from their forefathers the love of the beautiful and the grand; the facility for expression and the vivid imagination of the Latin race; the sonorous, majestic Spanish, the flexible, musical Portuguese, and French, the language of art; and a responsive chord to all that thrills, be it color, harmony or mental imagery. They have also inherited from those ancestors their varying moods, their noble traits and their shortcomings, both of which have been preserved, and in certain cases improved, under the influence of environment, the majestic mountains, primæval forests, ever blooming tropical flowers, birds of sweetest songs and wonderful plumage; under magnificent skies and the inspiration drawn from other poets and writers, foreign and native.

Much more might be said to show the constant endeavor of Latin America to co-operate with its best efforts to the civilization of the world. It has contributed readily according to its Latin standards, and from the day of its independence and the establishment of republican institutions Latin America has recognized the rights of man, abolished slavery, fostered education, developed its commerce and increased traveling facilities and means of communication with the outer world. It has contributed to the best of its ability to the sum total of human betterment, and the day cannot be far off when full justice will be done to the efforts of the countries south of the United States, where live a people intelligent, progressive, proud of their history and their own efforts, and ready to extend a friendly hand and a sincere welcome to those who are willing to understand them, and aid them on their road to progress.

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3. EDUCATION IN LATIN AMERICA.

General and Historical.— Education in Latin America is dominated by two forces. One is historical and concerns higher and professional studies. The Spanish colonists established universities soon after their occupation of the country. Santo Domingo, 1538; Lima, 1551; Mexico, 1553; Bogotá, 1572; Córdoba in Argentina, 1613; Chuquisaca (now Sucre) in Bolivia, 1623. Six others were founded by the end of the colonial period. They had charters from the king of Spain and from the Pope, and enjoyed the monopoly of granting degrees. Preparation was obtained only in church schools and by private tutoring. The universities themselves were conducted by the religious orders. They were organized and conducted solely in the interest of the colonial aristocracy. To-day they are national and theoretically open to all classes with small tuition fees and very generally include engineering schools. However, their traditional characteristics persist. They overemphasize theory, culture, dialectics, and make their appeal to the leisure class. They exercise little or no direct influence on elementary instruction. On the other hand, they dominate the secondary schools, which too often are but feeders to the universities, imitating their methods, reflecting their traditional spirit, and are likewise limited in patronage almost exclusively to the wealthy classes.

The other force in Latin-American education, the movement for elementary education, is recent and comes from abroad. Before 1860 no state had any well-defined system of elementary instruction. During the presidency of Sarmiento (1868–74) Argentina inaugurated a determined movement for universal elementary instruction. Sarmiento was influenced by the example of the United States. About the same time Chile undertook seriously the national organization of elementary schools. France has been rightly called the intellectual mother of Latin America, and when the French republic from 1870 on strove to banish illiteracy from France, its influence was not without great effect in Spanish America. All the states soon put upon their statute books laws for compulsory primary education. The reform has not progressed uniformly. Argentina, Chile and Uruguay in South America and Costa Rica in Central America have made the greatest progress. Whereas in these states 50 years ago illiteracy was perhaps more than 90 per cent, it is now less than 50 and rapidly decreasing. In some of the other states it is still 90 per cent. Cuba has made commendable progress in elementary education since its independence. The least progress has been made in those countries where the Indian and Mestizo population is the largest, or where strong clerical influence hampers the national and secular school organization. In such countries school statistics are often misleading. Many schools exist only on paper, in others the terms are short, average attendance is low and the law of compulsory attendance is not enforced.

Primary Education.— The standard period of the elementary school is six years, but even in a country like Argentina the full length is observed only in cities and larger towns. The villages and countryside maintain curricula of but two, three or sometimes four years. The school year approximates nine months. The subjects of instruction are reading, writing, arithmetic, drawing, geography and national history. As far as the mere ability to read is concerned, the short period of elementary schooling which obtains in so many localities is in part compensated for by the phonetic spelling of Spanish, and as concerns simple calculation by the use of the metric system. Genuine intellectual development, however, suffers severely from the short term of schooling for the average child. Elementary teachers are as a rule underpaid, and are seldom from the upper classes. The sharp class distinctions which so generally prevail in Latin America, especially in countries with a large mestizo population, are nowhere more noticeable than in the schools. Except in Argentina, and in a lesser degree in Uruguay and Costa Rica, children of the upper classes of society seldom attend the elementary public schools. They receive their primary education either through private tutoring or in private select schools, or in primary grades attached to the state secondary schools. This practice tends to foster and accentuate class distinction and makes of the public elementary instruction purely folk schools — a condition of affairs much to be regretted in a democracy.

In a few countries there is a surprisingly strong tendency toward coeducation in the elementary schools, but in general the policy is segregation of the sexes. In cities and larger towns segregation is practised in all grades. In smaller communities boys and girls are taught together in the first two or three grades and segregated in the higher grades. In rural and small village schools where the range of instruction is limited (from two to four grades) the classes are usually open to both sexes.

Except in the federated republics (Argentina, Brazil, Mexico and Venezuela) the primary school system is thoroughly centralized and directed even in the smallest details from the national capital. The funds are appropriated from the national treasury, the administration is vested in the council of elementary education under the Minister of Public Instruction. This council fixes the curriculum and methods, provides the building and equipment, establishes qualifications of teachers, assigns teachers to their posts and fixes their salaries. Frequently there is a local board of education chosen by the municipality or named by the governor of the province. Its authority is, however, carefully limited. Its principal functions are to care for the material equipment (building, etc.), to recommend suitable teachers, and when the teacher has been appointed, to see that he performs his assigned duties and maintains a proper scholastic, moral and civic attitude. Sometimes the local board is expected to provide from local funds the building and equipment. Great numbers of primary schools are conducted in rented buildings.

In the federated republics the state systems are a copy of the national system of the centralized republics. The tendency, therefore, is toward centralization over a larger or smaller extent of territory and close uniformity. Such a system has undoubed advantages and was the only one that could cope with the difficulties that confronted popular education in Latin America. In Argentina the national government has recently asserted the right to establish, maintain and control national elementary schools in those states where the local authorities do not provide an adequate system. In some countries, especially in Mexico, the municipalities establish and maintain elementary schools irrespective of the state system. These schools are usually better equipped and conducted than the state schools since the very fact of their establishment is an indication that state-wide interest in popular education is deficient or non-existent.

Normal Schools.— Those countries which have done most for primary education lay great stress on their normal high schools, which have come to be the secondary schools of the common people, as well as training schools for primary teachers. These schools were originally an importation and came with the impetus for universal and obligatory primary instruction. Many of the first masters were brought from Europe and the United States, and the schools were organized on the model of the French primary normal school and the original independent normal school of the United States. The requirement for entrance is completion of the elementary school course (six years) or its equivalent. The curriculum covers four, five and six years. The studies embrace what is usually found in grades 7 to 12 of American junior and regular high schools with the addition of pedagogy, observation of teaching and practice teaching in the annexed model school. Many normals are boarding schools. Whether boarding or day schools the usual practice is for the state to maintain the scholars, lodging, feeding and clothing them in the boarding schools, or paying them a commutation in the day schools. In return the scholars enlist in the teaching service of the state for a certain number of years. In case they do not serve out their enlistment, they agree to reimburse the govenment. A bond is given to ensure the observance of the contract. Unfortunately, in many countries this contract is not always observed. The normal school students come from the lower middle class, if indeed one can speak of a middle class in the average Latin-American society, and their advancement into the higher grades of instruction, even with industry and ability, is difficult and rare. Their limited education is a handicap, and the line of demarcation between the normal and elementary schools on one hand and the secondary and university education on the other is so sharply drawn that it is next to impossible to pass from the one to the other. Chile and Argentina maintain higher normal schools of college rank for the training of primary normal school instructors, and, to a limited extent, for the training of regular high school teachers, but the latter are more usually recruited from the universities and lack distinct pedagogical preparation. The boarding normal schools very naturally are for one sex or the other, but in the day schools coeducation is surprisingly common. A model school is always attached to a normal school, and much stress is laid upon practice teaching, although much more time is devoted to observation than to actual practice.

Secondary Education.— The standard period of the regular secondary schools (*Liceos*) is six years, but in some countries it is less. These schools are usually good of their type even in countries where primary education has been neglected. Their clientele is largely from the upper classes. Church and private schools of this grade are numerous, but the state retains (as in France) the right of examination and power to grant the degree (bachelor of humanities) at the end of the course. The curriculum is, as a rule, uniform and comprises the Spanish language and literature, general and national history, mathematics, physics, chemistry and biology (usually without individual laboratory practice), French, English, elementary philosophy and economics. Latin is seldom included. The uniform curriculum in the secondary schools is due to their close administrative relation with the universities. They are still regarded as mere preparatory schools. When commercial and industrial education was introduced, it seemed more politic to divorce it wholly from the traditional secondary schools, as had been done with the primary normal training. Hence almost everywhere commercial and industrial schools are separate institutions although state supported. When they are combined with the regular high school, it is for economic, not pedagogical or administrative reasons. Notwithstanding the relative excellence of the regular high school, it suffers from the lack of trained and professional teachers. Much of the instruction is given by university graduates who divide their time between a number of schools or who carry on a profession (law, medicine, pharmacy, journalism, etc.) at the same time. Their teaching is necessarily often a secondary consideration and their attendance irregular. They frequently lack ability really to teach. The recitation is apt to become a lecture as in the university.

Commercial Education.— The commercial school in many Latin-American countries occupies a position of high favor, receives liberal state support and opens an avenue to young people who could not hope to profit materially by the regular high school course. It is usually a combination of upper primary and junior high school. The curriculum comprises the traditional subjects of the fourth, fifth and sixth grades of the elementary school with a commercial orientation of arithmetic, geography and composition, while introducing the specific commercial branches, typewriting, stenography and accounting. Much stress is laid upon modern foreign languages, especially English and French. These schools often receive important gifts and even regular subsidies from public-spirited citizens and commercial organizations. Evening as well as day classes are the rule in these institutions, and some have evening classes only. Unfortunately relatively few pupils complete the entire curriculum. They leave the school after acquiring the mere rudiments of a commercial education to accept modest employment in business.

Higher and Professional Education.— The universities are professional schools almost exclusively. A very few have faculties of letters and pure science. The standard university contains faculties of law, medicine, engineering, commerce and agriculture; but many have only two or three faculties. Medical departments include schools of pharmacy, dentistry and midwifery. The average course of study in law covers six years; in medicine, six; in engineering and agriculture, four; in commerce, four; in pharmacy and dentistry, three.

The enrolment in Latin-American universities is surprisingly large. Buenos Aires has approximately 6,000 (exclusive of the attached preparatory high school); Santiago 2,000, Lima 1,100, Montevideo 900 exclusive of the agricultural college, a separate institution, and others in proportion to population and degree of general culture. The explanation is found in the fact that although the institutions are merely groups of professional schools, they also fill the place occupied by the liberal arts college in the United States, and many students attend with no expectation of following the profession they are studying. They take a university course for general culture or for the sake of the doctor's degree which is conferred upon graduation. Not nearly half the graduates in law and not more than half in medicine practise the profession. The law course especially is regarded as a liberal education, being less technical than in an American law school and including at least the rudiments of all the social sciences, psychology, economics, sociology, constitutional history, as well as the philosophy and history of law, and international law. It is in fact a study of jurisprudence in the wide sense, and leads to the degree of doctor of jurisprudence. The medical college with its adjunct departments usually has the largest enrolment. The curriculum is long and full. Not as much stress is laid upon chemistry and the other basic sciences of medicine as there should be, but the clinical instruction and practice is excellent. Agriculture, the last of the faculties to be introduced, is much encouraged by the governments and receives generous support. The enrolment, however, is limited. All the states have one or more schools of agriculture either as part of a university or existing as a separate institution.

Organization of Universities.— Practically all institutions of higher and professional instruction in Latin America are state supported and state controlled. In a few centres there are church colleges of law, engineering, etc., but never of medicine. These colleges do not confer the degree of the profession. That privilege is reserved for the state university. Most state universities are autonomous; i.e., they are governed directly by the faculty, which is a self-perpetuating corporation. However, the election to a vacant chair must be confirmed by the President of the republic through the Minister of Public Instruction. The common practice is for the faculty to nominate three candidates for a vacancy of whom the minister selects one. The state exercises in this way a control over the personnel, but usually the faculty indicates its choice of the candidates, and the minister rarely rejects the nomination. The universities have thus acquired almost everywhere complete independence. Their revenue, of course, depends largely on the will of the national (or provincial) legislature. University professors, like those of the secondary schools in Latin America, are rarely teachers by profession. The law is taught by practicing lawyers and judges in office; medicine, by practicing physicians. This custom has the same disadvantages though not so marked as in the Liceos. A professor usually teaches but one course which consists of three lectures or recitations per week. If a course runs through two years, one man will teach the first year, another the second. This custom accounts for the large number of professors in an institution in proportion to the students, the ratio being often in the smaller universities as high as one to five. The different colleges of a university are usually scattered, the college of law being located in one part of the city, the college of medicine in another, etc. Each has its own library and laboratories. This necessitates a duplication of material and often a duplication of instruction since matriculation in the university is directly from the high school, and certain basic subjects are taught in two or more colleges. Especially is this true of the basic sciences of medicine, engineering and agriculture. The universities are very generally open to both sexes, and women are enrolled in considerable numbers in the colleges of medicine, pharmacy, dentistry, education and architecture.

So-called practical schools of agriculture and industrial arts are very common and are supported or subsidized by the state. They are of lower rank than the university professional schools and are for the training of overseers, foremen, artisans and farmers. The agricultural states have featured the practical agricultural school in recent years. Argentina has a score of them of different grade. Some are designed to emphasize the type of agriculture in the region where they are located, fruit growing, cattle raising, sugar industry, etc.; others have a general curriculum. They admit boys with the mere fundamentals of instruction from the third or fourth grade, and continue their common school instruction, adding the professional branches. The curriculum extends over three or four years. Many of these institutions are boarding schools. The system is very similar in other states. Chile maintains them in the agricultural region; Cuba has one in each of the six provinces. In Brazil and Mexico it is the concern of the individual states, the national government concerning itself only with the higher professional schools.

Industrial Education.— The practical industrial schools (Escuelas de artes y oficios) have the same status and occupy a corresponding position in the industrial field. They are supposed to reduce theory to the minimum and bend their energies to the practical. This is especially difficult, however, in Latin America since the tradition in education there for centuries has been in favor of theory, and the racial mind is forcibly bent in that direction. In the most enterprising countries there are trade schools for girls as well as for boys. Chile, for example, has a great number for girls, one or more in almost every important town. The introduction of industrial and agricultural education into the regular primary schools is uncommon. The tendency is to make them separate departments of instruction. Both at Buenos Aires and at Santiago, Chile, there is a school of industrial arts which occupies a middle ground between the ordinary elementary trades school and the engineering college. They are well equipped and train a high type of artisan and practical engineer. Many elementary trade schools are conducted by various orders of the Roman Catholic Church. The Salesian Brothers make a specialty of this type of education. Some of these schools combine elementary agricultural training with schooling in the industrial arts. They usually receive a subsidy from the local, provincial or national treasury. The pupils come from very poor families or are orphans.

Theological Education.— Preparation for the Roman Catholic priesthood is given in church schools which are wholly removed from governmental supervision. At least one such school is maintained in each diocese· from whence the more gifted boys are sent to the arch-diocesan school in the capital for advanced instruction and training. The lesser priesthood may be recruited directly from the diocesan school. These institutions necessarily have a different curriculum from that of the state and state-supervised elementary and secondary schools, not only in the emphasis laid upon strictly religious instruction, but also in the inclusion of Latin which is seldom found in the Spanish-American curriculum; in fact, in many states the study of Latin in the state and state-inspected schools is forbidden by law.

Education in Brazil.— In Brazil little was done for popular education before the advent of the republic (1889). It is delegated wholly to the individual states. Some, notably São Paulo and other southern states, have made commendable progress; others have done very little. The type of instruction is much the same as in Spanish America. The same is true of secondary education. Brazil has two national schools of law (São Paulo and Recife) and two of medicine (Rio de Janeiro and São Salvador) but since 1911 their graduates have no rights not enjoyed by graduates of other standard institutions. The tendency now is to establish universities; i.e., groups of professional schools, in all the state capitals.

Conclusion.— Popular education is retarded in Latin America by various causes of which some are operative in some countries, others in others, and some in all. They may be summarized as follows: (1) Apathy of Indian and Mestizo population; (2) lack of trained teachers; (3) opposition of church to secular schools; (4) greater relative importance and appropriations given to university and secondary instruction; (5) want of proper buildings, textbooks and equipment; (6) sharply accentuated class distinctions; (7) traditional curricula and inefficient methods of instruction.

Notwithstanding all the discouraging circumstances, there is everywhere a universal ambition to overcome illiteracy, a realization that an educated citizenry is necessary for political, economic and social progress, a willingness to learn modern educational methods, and an ever-increasing adaptability of instruction to local and racial needs.

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4. LATIN AMERICAN LITERATURE, the literature of the various nations and peoples on the American continents speaking the Latin languages. In this wide sense the term embraces the Spanish, French and Portuguese countries and, therefore, includes the literary productions of French Canada and other French colonial possessions in America, past and present. In the restricted sense in which the term is employed in this article, however, it deals only with the literatures of the Spanish and Portuguese countries of the New World which have achieved national existence and which have, consequently, been for years facing each the problems of its national life and producing a national literature. In a general sense the literatures of all the Latin-American countries are very much alike, just as the literatures of all English-speaking countries have a marked resemblance. The heritage of language, customs, laws, government, social usages and literature have made this necessarily so. Yet the differences are, in most cases, as marked as the resemblances. In a general way the literature of the Spanish-American countries holds the same relation to that of Spain that American literature does to that of England. It represents the multiple and varying interests of the great Spanish colonial land in the New World. It has ever clung to the literary traditions of the mother country, and Spain's influence upon Spanish-American literature has been, in a sense, paramount. But just as Spanish colonial America has ever been different from British colonial America, so this difference is reflected in the literatures of the two countries. England never had a very strong hold upon her colonial possessions in America; and she consequently never entered very fully into their lives.

But the conditions under which the Spanish-American colonies grew up were quite different from those of the English-American colonies. From the early days of her contact with the New World Spain not only identified herself with her colonies but she kept such a firm hand upon their government that the colonies themselves were never anything but an echo of the mother-country. The vast Indian population of the Spanish-American colonies made their government a very serious problem, which for the first century following the conquest made the interests of Spaniards in America identical with those of Spain. During the three centuries of Spanish rule in the New World, Mexico and Peru gave birth to by far the greater part of the Spanish-American literature. The literary productions of these countries, while exhibiting a certain amount of individuality, is during this period essentially Spanish; and the greater part of it is the work of Spaniards or of sons of Spaniards born in America. This Latin-American literature, whether it treat of things American or Spanish, is markedly a re-echo of the literary life and ideals of Spain. Nevertheless it is interesting and of very considerable importance because of the fact that, while it invariably followed Spanish literary models, it necessarily very frequently treats of things American in a way that reveals the life of the colonies and the relation of the Spanish adventurers and of the Spanish government to the natives of the New World. An important part of it also deals with the history, customs, habits, religion, traditions and superstitions of the American races preceding and immediately following the discovery of the New World and the contact of Europe with America.

The Colonial Period.— The two favorite colonies of Spain in America were Mexico and Peru, the former, because it was the first great territory conquered; and the latter, because of its wealth in the precious metals which gave it material importance over all the other Spanish-American colonies. The early prominence of these two colonies attracted to them great numbers of Spaniards of all classes, among them many of high title, family connection and excellent education. To these, to priests and friars and to native Indian writers we owe a great part of the early colonial literature. Mexico's part in this colonial literature is fully discussed in the article on Mexican Literature (q.v.). In general this early literature consists of letters and similar documents relating to the conquest, settlement and administration of the colonies, to the customs and habits of the Indians and to their pre-conquest history. The literature contributed by the priests and monks consists of works largely relating to the Christianizing of the natives and it includes invaluable texts of a religious nature written in the numerous native tongues of the aborigines. Some of these works are of a much more extensive, ambitious and valuable nature than others. Among these are the 'Historia de las Indias' of Fray Bratolomé de Las Casas (q.v.); the 'Historia General de las Cosas de Nueva España' of Padre Bernardino de Sahagún and other works on the antiquities of Mexico by the same author; 'Historia natural y moral de las Indias,' by Padre de Acosta (1580); the 'Monarchia India' of Padre Torquemada (1615) (q.v.); the 'Storia Antica del Messico' by the Abbé Clavigero (1780), all of Mexico; the 'Inca Ceremonial and Religion' of Cristóbal de Molina of Cuzco (between 1570 and 1584); the 'Extirpación de la Idolatría del Perú' of Pablo José de Arriaga; and the 'Relación de las costumbres antiguas de los naturales del Perú,' by an anonymous Jesuit priest. These, however, are but a few of the numerous and valuable works of this kind, to which are due much of our knowledge of pre-Columbian civilization in America and of the events immediately succeeding the conquest and the relationship of the Spaniards to the natives. But this early period of Spanish-American colonial history produced laymen who have left as valuable and as vivid accounts of the same period as have the representatives of the Church. Among these are Fernando de Santillán, 'Relación, etc.' (1550); Juan José de Betanzos, 'Account of the Incas' (1551); Pedro de Cieza de León, historian of the conquest of Peru (about 1554); Juan de Matienzo, 'Gobierno de El Perú'; Polo de Ondegardo, two 'Relaciones' giving an account of the laws and system of administration of the Incas of Peru (between 1561 and 1571); Bernal Díaz del Castillo, 'Historia Verdadera de la Conquista de Nueva España' (toward the end of the 16th century); F. de Alva Ixtlilxóchitl, 'Relaciones' and 'Historia Chichimeca' (end of the 16th century); Francisco de Avila, a work on the Indians of Huarochiri, their gods and their superstitions; Pachacuti Yamqui Salcamayhua, 'Relación de antiguedades deste Reyno del Perú'; Miguel Cavello Balboa of Quito, 'Miscellane Austral,' giving information on the war between Huascar and Athauhuallpa and Indian coast history generally (1576); Fernando Montesinos, 'Memorias antiguas historiales del Perú,' and 'Anales y memorias nuevas del Perú'; Antonio de Herrera, 'Historia general de los hechos de los castellanos en la Isla y Tierra Firme del Mar Océano' (1601); Garcilaso de la Vega (the Inca), 'Comentarios reales' and other works (early in the 17th century); López de Gomara, 'Historia General de las Indias' (1616); Alonzo Ramos Gavilán, 'Historia de Copacabana et de su Milagrosa Imagen' (1620); Antonio de la Calancha, 'Order of San Agustin,' in which he gives a history of the Incas (1638–50); Juan de Velasco, 'Historia de Reino del Quito'; Ioannes de Laet, 'Novus Orbis' (1633); Sánchez de Aguilar, 'Informe contra idolorum cultores Obispado de Yucatán' (1639); Villagutierre y Sotomayor, 'Historia de la conquista de la Provincia de el Itzá' (1701); Cogolludo, D. L., 'Historia de Yucatán' (1688).

In addition to these serious historical works the first period following the conquest saw many writers of personal narratives, heroic, narrative and semi-lyrical poems, a considerable number of which were based on personal adventures or reputed to be so. These chronicles are interesting for the light they give on the obscure history, customs, quarrels and habits of the period. Among these are the rhymed chronicles, 'La Araucana' of Alonso Ercilla y Zuñiga of Chile (1533–94); also 'Arauco Domado' (1596), 'El Vasauro' (1633) and 'El Ignacio de Loyola' of Pedro de Oña, also of Chile; 'Purén Indómito' of Hernando Alvarez of Toledo; the 'Compendio historico de Chile' of Melchor Xufre del Aguila (1568–1637); the 'Conquista del Nuevo Mundo' of Gaspar de Villagrá (1610); the 'Elegias de Varones ilustres de Indias' of Juan de Castellanos; the 'Peregrino Indiano' of Antonio Saavedra Guzmán (1599), of Mexico; México Conquistada' of Juan de Escóiquiz; the 'Cortés Valeroso' of Gabriel Lasso de la Vega (1594); and the 'Hernandia' of Francisco Ruiz. (See an account of these under Mexican Literature). Ambitious "epic poems" of a very similar nature appeared in the Argentine, Peru and Brazil. The various branches of this extensive literature acted and reacted upon one another, throughout the Spanish and Portuguese colonies in America and in Spain and Portugal; for in this the colonies were following in the footsteps of the mother countries; though some of the American poems were superior to a very considerable body of the European end of the literature. Many of these rhymed chronicles were little more than prose, and their authors would often have probably done better if they had used prose as their vehicle of communication instead of poetry. Yet, to-day, they are looked upon as valuable owing to the sidelights they throw upon the age in which they were written. But their popularity prevented the production of prose works of a similar character to any great extent. However there were a few prose productions which had considerable influence upon colonial literature owing to their general popularity and the extent to which they were read throughout Latin America. Among these were the 'Cautiverio feliz' of Francisco Nuñez de Piñeda, written in the latter half of the 17th century; and the 'Restauración de la Imperial y conversión de almas infieles' of Fray Juan Barrenechea (1693). The religious literature depicting the lives of the saints and other sacred characters during the first two centuries of Spanish rule in America, though plentiful, is of no great interest, except in so far as it shows the efforts the priests and monks made to present religious dogma in a pleasing form for the enlightenment of the Europeans in America and in a still simpler and more realistic form for the instruction of the Indian and mestizo population (See account of the religious drama in the article on Mexican Literature). Of the most interesting and ambitious religious epics of this period are 'La Cristiada' of Fray Diego de Ojeda of Lima (1611); and the 'Santa Rosa de Lima' of Luis Antonio de Ovedo (Peru 1711). The most interesting chronicler (and a fairly good poet) of the first century of the Spanish occupation of America was Bernardo de Balbuena (for whom, see Mexican Literature).

The period under consideration produced a great amount of verse, apart from the rhymed chronicles. Much of this has been lost and such of it as has been preserved is, on the whole, not of a very high class (See Mexican Literature for an account of literature of this nature in New Spain). Among the few poetical works of the period that are still of interest are the 'Miscelanea austral' of Diego de Avalos of Lima (1603); the 'Parnaso Antârtico de obras amatorias' of Diego Mejiá (1608); and the 'Ramillete de varias flores poéticas' of Jacinto de Evia of Guayaquil (1673); and the 'Diente del Parnaso' of Juan del Valle of Lima about 1681. A somewhat similar work by Fray Juan de Velasco, 'El Ocioso de Faenza,' has preserved, in six volumes, the best of the poetry of his age in Quito and the territory subject to it. The same author, in 'Historia del reino de Quito' also gives some very interesting historical and other material relative to this ancient stronghold of the Indian empire of the Pacific coast.

The body of Spanish-American literature of the colonial period, on the whole, faithfully represents the life in Spanish America, with its adventures, its strongly religious element and its close relation to the mother country. A part of it, too, shows the Indian side of the question. This latter is strongly brought out in such works as 'Ollanta,' a Peruvian drama written in the Quichua language; 'Cautiverio feliz' (already mentioned) of Francisco Nuñez de Piñeda; and the drama 'Siripo' of Manuel José Labardén, an Argentino (1789).

Throughout the colonial period of Latin-American literature, Mexico, Colombia, Peru and Chile acted and reacted upon one another in some manner; but their literary resemblance to one another is more due to their common familiarity with and imitation of Spanish writers. For this reason they have all been reviewed under one head. But the Revolutionary period and the years following have seen a very considerable divergency in literary aspirations and achievements throughout all the republics which had their origin in the Spanish-American colonial possessions. Therefore it has been found convenient to treat the literature of each one of these nations separately, connecting them only when it is necessary to show the influence that one national literature has had upon the others.

Revolutionary Period.— The general characteristic of the literature of the Revolutionary period throughout Latin America is that of a strong resentment against Spain, an intense, somewhat idealized desire for liberty, and a general breaking away from the old order of things. It signified also the rise to power of the native population of the various colonies as distinguished from the Spanish-born rulers. It was inspired by the Napoleonic conflict in Europe, the troubles in which the Spanish government found itself, and by the ideals of the American and the French revolutions. (For the restrictions placed upon native Indians and Spanish creoles, see Mexican Literature). Naturally, possessing the ideas on government that they did, and the antipathy to Spanish rule that they had shown for some years, the American revolutionists inclined strongly toward republican institutions. Once each country secured its independence the people proceeded to set up a republic in name at least. This feeling toward Spain and Spanish government and this love for republicanism and for the institutions of the United States and France are strongly reflected in the Latin-American literature of the Revolutionary period; and the more revolutionary the writers and the more they showed their hatred for the past the more they were likely to be popular with their fellow countrymen. Yet for all this there is, at the beginning of republican institutions in Spanish-America, very little literary breaking away from Spain, whose literary bondage had become so firm and lasting that it may still be said to remain comparatively firm. The revolutionary writers who sprang into prominence in the Spanish-American colonies used the Spanish language in all its varied literary forms as their most powerful weapon against the mother-country, at the same time fanning the native hatred against everything Spanish. The whole land was sharply divided into two parties, those who were pro-Spanish and those who were anti-Spanish. The latter identified themselves with the cause of the Indian and the mestizo. The slumbering hatred of the oppressors who had so cruelly treated, for three centuries, the descendants of the native races, and had kept them in bondage, burst forth with terrible intensity and Spaniards were everywhere treated with the same cruelty that they had meted out to the vanquished natives. All this is reflected in the Spanish-American literature of the revolutionary period. Though it falls short of correct literary form, this literature never lacks intensity and directness of aim. Much of it is very bitter; and the greater part of it still more markedly local in its point of view. But it has in it a sense of individuality and the breath of national freedom which had never before been known in Spanish America. This revolutionary feeling is strongly exhibited in the 'Marcha patriotica' of the Argentina, López y Planes, which, though it was long the national anthem of the Argentine, is intensely anti-Spanish. Most of the literature of this period is controversial and political and shows all the ear-marks of having been written for revolutionary ends. Little of it is of very great value from a literary point of view. Its worth, however, consists in the fact that it served as a training field for the writers who were to follow in all the countries of Latin America and to produce, in each case, a national literature.

Argentina.— The early literature of the Argentine Republic is filled with the revolutionary spirit that gave birth to the nation. Of the early Argentine poets one of the best is Juan Cruz Varela (1794–1839). His work expresses well the spirit of his age in its intenseness and intolerance. Two of his dramas, 'Dido' (1823), and 'Argia' (1824), were very popular with his own party, as was also his campaign poetry directed against the tyrant, Juan Manuel Rosas, President of the republic by right of conquest. A poet of much promise, marked simplicity and charm was Florencio Balcarce (1815–39) whose naturalness made him a great favorite. The most influential, however, of these early Argentine poets was Esteban Echeverría (1803–51). A profound student of English, French, German and Spanish poetry, and partially educated in Europe, he decided to make literature his life work. He published 'Elvira' in 1832. This was followed shortly by 'Los consuelos,' a volume of Byronic verse, which at once became popular; and by 'Rimas' (1837). One of the poems in the latter, 'La Cautiva,' sets forth a new literary creed for Latin America and breaks away from established and entrenched literary forms. For this reason it has had much influence upon subsequent Latin-American literature. Among his other longer poems are 'Celia,' 'El Angel Caido' and 'Avellaneda.' Like many of his contemporaries, Echeverría spent his latter years in exile from which he thundered against the tyrant ruler of the Argentine. Another exile, José Mármol (1818–81), a companion of Echeverría in Montevideo, was a poet, novelist and political writer of great force, imagination and considerable originality. His most notable works are his novel 'Amelia' which was widely read; his numerous quatrains; his long narrative Byronesque poem 'El Peregrino' and his two dramas 'El Cruzado' and 'El Poeta.' Two other political exiles and writers of influence were Claudio Mamerto Cuenca (1812–52), and José Rivera Indarte (1814–45). The former left two dramas. 'Muza' and 'Don Tadeo,' and three volumes of poems published as 'Delicios del corazón.' One of the best of the poets of the first half of the life of the republic is Juan María Gutiérrez (1809–78), a follower of the doctrine of Echeverría that American poetry should be distinctly American. His works include 'Los Amores del Payador' (1838); 'América Poetica' (a collection of shorter poems, 1846); and 'Estudios Biográficos.' Other poets of talent of this same period are Vicente Fidel López (1815–1903); Juan Bautista Alberdi (1810–84); Luís Domínguez (1819–98) and Bartolomé Mitre (1821–1906). The latter, who became President of the republic and who proved himself a very successful soldier and leader of men, was a poet of considerable merit, a noted journalist and one of the best historians and biographers of his country. Another journalist, Domingo Faustino Sarmiento (1811–88), played a very prominent literary and political part in the history of the Argentine, becoming a powerful journalistic factor, a leader in politics, President of the republic, a reformer in education and a university professor of note. His book 'Facundo' which reveals his political and social ideas, is characterized by brilliant descriptions of Argentine and mountain scenery and pictures of the life of the country, especially that of the interior on the great pampas. Among his other works of note are 'Educatión popular,' 'Viajes por Europa, Africa y América,' and 'Recuerdos de Provincia'; but his complete writings make up close upon 50 volumes, in which the treatment of educational and political subjects form a very considerable part. It is probable that Sarmiento was influenced in his descriptions of the gaucho and his life by the work on the same subject by Hilario Ascásubi (1807–75) whose 'Media Caña del Campo' became almost a text in the army fighting Rosas. His other important works, all essentially Argentine in sentiment, subject and treatment, are 'Paulino Lucero' (a series of gaucho espisodes published between 1839 and 1851); and 'Santos Vega.' The gaucho continued to play an important part in Argentine literature for a considerable time and to aid in forming the realism of the national literature on a sounder basis. This gaucho movement, combined with the traditions of the Classicists and the influence of the Romantic movement in Europe and especially in France, may be said to have been the motor power behind the movement that produced the Modernists in the Argentine and other Latin-American countries. Of the Argentine classical writers one of the most important leaders was Carlos Guido y Spano, who was born in 1829 and continued, throughout a long life, to influence the literature of his country for purity of style and love of classical tradition, through his journalistic articles and his published works. His best-known collection is 'Hojas al viento' (1871). José Fernández (1834–86), another journalist, was one of the most widely read poets and writers in his country. His 'Martín Fierro' (1872), and 'La Vuelta de Martin Fierro' offer some of the best pictures of gaucho life in the Argentine presented in any work to date. Estanislau del Campo, a year younger than Fernández, also helped to make the gaucho famous. His 'Fausto,' a poem written in the gaucho dialect, is full of the spirit of the wild presented in a very artistic and spirited manner. Olegario Victor Andrade (1838–83), who was 42 years of age before he was any way well known in literary circles, became suddenly famous not only in his own country but outside it and acquired the reputation of being one of the two or three best poets of the country; and by many critics he is held to be the best. The most characteristic and worthy of his poems is 'Prometeo.' To this period belongs Ricardo Gutiérrez (1836–96), poet and novelist, who is credited with being the best of all the interpreters of criollo life in the Argentine. His work shows a powerful imagination, great sympathy and striking ability to depict the life, feelings and passions of the lower classes on the great plains of Argentina. Carlos Encina (1839–82), in his two works 'Canto al arte' and 'La lucha por la idea' made himself the leader of what may be called the æsthetic school in Argentine literature, a school which was destined to widely influence Latin-American literature and to have its effect on that of Spain through the Modernistas. Martin Coronado, a contemporary of Encina, was a narrative poet of considerable power and the possessor of a large fund of humor. Among his most popular works are 'Los Hijos de la Pampa,' 'Angela,' and several dramas, the best of which are 'La Rosa Blanca' (1877), and 'Luz de Luna y Luz de Incendio' (1878). One of the best Argentine interpreters of nature is Rafael Obligado, a follower of the school of Echeverría. His poetry is romantic in form, tender in sentiment and free in movement. Gervasio Méndez (1849–98), the poet of melancholy, bed-bound most of his life, set the fashion for a sort of melancholy poetry which was in great favor in the Argentine during the latter quarter of the 19th century. Eugenio Cambaceres, a contemporary of Méndez, was his direct opposite. His naturalism was so marked that he had difficulty in gaining the attention of the public. His first two works, 'Sibidos de un vago' (1882); 'Música sentimental' (1883) and 'Sin rumbo' (1885), gradually overcame the antipathy of the public and his 'En la sangre' (1887) made his reputation as a painter of the national life, especially of the mixed population of Buenos Aires. Martín Garciá Mérou, born in 1862, is one of the most voluminous of modern Argentine writers, having already published some 16 volumes covering literary criticism, descriptive studies of foreign countries, tales and poems, novels and history. The list of younger Argentine writers is long and includes, among others, Domingo Martinto, Luís S. Ocampo, Alberto Navarro Viola, Adolfo Mitre, Julio E. Mitre, Enrique E. Rivarola, Rubén Darió (q.v.), Juan Mas, Emilio Berisso, Manuel Gálvez, Eugenio Díaz Romero, Ricardo Rojas, Alvaro M. Lafinur, Albero Giraldo, Antonio Argerich, Paul Groussac, Lucio Vicente López and Enrique Rodríguez Larreta. Some of the later Argentine novelists are worthy of special attention. Among these are two who have won attention in Europe. Carlos María Ocantos has an audience throughout Spain and Latin America. He has written many novels, the best of which are 'León Saldívar,' 'Don Perfecto,' 'El Peligro.' Emma de la Barra, who writes under the pen name of «César Duayen,» is the best of the woman novelists of the Argentine. Her most popular story, 'Stella,' depicts, in a vivid manner, fashionable society in the capital. In this field she disputes sovereighty with Martín Aldeo whose novel ‘La Novela de Torquato Méndez’ is in itself a vivid picture of the life of Buenos Aires.

Chile.— From the earliest days of the conquest Chile has been a land of historians and chroniclers, to some of which reference has been made in the earlier section of this article. Many of the historical works of Chile are excellent; and she has shown considerable talent for essays and writings of a like nature. But it is in the novel, in more recent times at least, that Chilean literature has given the greatest promise. One of the earliest and most voluminous of Chilean novelists was Liborio Brieba, whose plots are set in the revolutionary period of native history. They are often spoiled by crude presentation of crime and fantastic plots. The work of Martín Palma (1821–84) is in every way better than that of Brieba. He was journalist, controversialist, free-thinker and tractarian. Among his novels are ‘Los Secretos del Pueblo’ (1869); ‘La Felicidad del Matrimonio’ (1870); ‘Los Misterios del Confesionario’ (1874, translated into English). The success of his novels brought forth numerous imitators. Miguel Luís Amunátegui (1828–88) who worked with his younger brother Gregorio, was the first trustworthy critic of Latin-American poetry and poets. Their works include, among much published matter, ‘Juicios críticos de algunos poetas hispano-americanos’; ‘La Alborada poetica en Chile’ and ‘Primeras representaciones dramaticas en Chile.’ The most copious biographer of Chile and probably of Latin America is Benjamín Vicuña Mackenna (1831–86), who has written more than 150 volumes on biographical-historical subjects. Diego Barros Arana (1830–1908), one of the most learned men and deepest thinkers of Chile, has left the best history of his native land, ‘Historia General de Chile,’ among numerous other historical works. Alberto Blest Gana, whose literary activity began in 1858, with a volume of striking stories dealing with contemporary society, is one of the best story writers and foremost novelists of Chile. Among his novels are ‘Pago de las Deudas’ (1860); ‘Martín Rivas’ (1862) and numerous shorter stories, all of which move along swiftly displaying one vividly painted scene or characterization after another. Ramón Vial (1833–96), a dramatist and comedy writer of considerable talent, possessed of an inexhaustible fund of humor and resources in dramatic comedy. Among his numerous works some of the best are ‘Mujer-hombre’; ‘Los extremos se tocan’ and ‘Gratitud y amor.’ Three writers all bearing the same family name, Daniel Barros Grez (born 1839), Vicente Grez (born 1843) and Borja Orijuela Grez, have all made names for themselves in Chilean literature. The former is the best of the Chilean writers of historical fiction. Among his novels are ‘El huérfano,’ ‘Primeras aventuras del maravilloso perro Cuatro Remos en Santiago’ and ‘Pipiolos y Pelucones’ (Liberals and Conservatives), all of which are written with keen wit, satire and humor. He was also successful as a writer for the stage, his best dramatic production being ‘El Tejedor.’ Vicente Grez (1843–1909), one of the most versatile of Chilean literary men, has produced some notable novels, among them ‘Emilia Reynals’ (1883); ‘La Dote de una joven’ (1884); ‘Marianita’ (1885); ‘El ideal de una esposa’ (1887); and a volume of poems ‘Ráfagas’ (1882). Borja Orihuela Grez is also a novelist and her ‘El cura civil’ is an excellent picture of certain phases of country life in the interior of Chile. Ramón Pacheco, who has been active as a novelist since the beginning of the last quarter of the 19th century, has found his field in episodes of native history. His best-known work, ‘El subterraneo de los Jesuitas’ (1878), has gone through several editions. Enrique del Solar (1844–), son of a famous mother, Mercedes Marín del Solar, is the author of a number of popular novels considerably above the average of their class, among them being ‘Dos Hermanos’; and ‘Una aventura en Ercilla.’ Luís Montt (1848–1909), poet, bibliographer, critic and editor, has done much to encourage the study of the history and literature of his native land. José Toribio Medina (1852–) is the greatest authority on the history of printing throughout Spanish America; and he has written the best and most appreciative history of the early literature of Chile. Valentín Mutillo (1840–) has written numerous novels, short stories and other literary productions stretching over a third of a century. The best known of these is a novel ‘Una víctima del honor’ (1871). Alejandro Silva de la Fuente is the author of several novels of promise; but they are hopelessly tragic. Among these are ‘Ventura’ (1885); and ‘Penas que matan’ (1887), which are the most characteristic of his earlier work. Alberto del Solar (1860–), traveler, diplomat, novelist and descriptive writer, has done some creditable work. Among his publications are ‘Huincahual’; ‘Rastaquoere’; and two novels, ‘Contra la marea’ and ‘El faro.’ One of the best short story writers of Chile is Luís Orrego Luco (1866–). He is also a successful novelist. Among his works which have attracted much attention are ‘Un idilio nuevo’ (1900); ‘Un voluntario de la patria vieja’ (1905); and ‘Casa grande’ (1908). Among the long list of other writers of Chile not mentioned are Pedro N. Cruz, story novelist; René Brickles; Emilio Rodríquez Mendoza, novelist; J. V. Lastarria; Baldomero Lillo; A. C. Espejo; F. Santibañez; R. Maluenda; G. L. Hubertson; all short story writers. J. J. Vallejo and Daniel Riquelme are both humorous writers popular in Chile.

Andrés Bello (1781–1865), as both poet and prose writer of varied talents and accomplishments, properly forms the connecting link between the prose and the poetical writers. Born in Venezuela he became the moving spirit in educational matters in Chile where he was soon recognized as the leader of the classical school of literature in his adopted country. Bello distinguished himself as a poet, journalist, literary leader, educator and writer of school and other books. Grammar, philosophy, mathematics, education, jurisprudence and international law were all handled by Bello in works of singular clearness and notable pedagogic construction. His position as president of the University of Chile increased his influence. José Joaquín de Mora (1784–1863), a naturalized Spaniard and a literary man of some ability, was the opponent of Bello in most of his educational and literary work. His ‘Leyendas Españolas’ had considerable influence upon the development of literature in Chile. The most notable woman writer of this period was Mercedes Marín de Solar (1804–66), a writer of occasional verses which have in them the imagery, imagination and vision that make true poetry. Salvador Sanfuentes (1817–60), jurist, educator, statesman and literary man, was Bello's most noted pupil. Among his poetical works are 'El Campananario,' Juana de Nápoles' (a drama), 'El Bandido,' 'Inami,' 'Huentemagu,' 'Ricardo y Lucía' and 'Teudo.' Sanfuentes has written extensively and interestingly with a true sympathy with nature and a keen eye for her beauties. José Victorino Lastarria (1817–88), one of the prime factors in the literary life of Chile in his age, wrote prose sketches, short stories, political essays and was the prime mover in the literary society and the Academia de Bellas Letras. His works include 'Antaño y hogaño,' 'Recuerdos literarios' and 'Lecciones de politica postiva.' The two sons of Andrés Bello, Juan (1825–60) and Carlos (1815–54), both wrote and translated dramas and generally helped on the literary movement in Chile. Carlos Bello's drama, 'Los Amores del Poeta' was very successful as were several of the dramatic adaptations of his brother. One of the stoutest liberals among the Chilean literary men of the middle of the 19th century was Francisco Bilbao (1823–65). Sociologist, historian, journalist and poet, he showed talent in every field. His best prose work is 'Sociabilidad Chilena.' A friend and supporter of the literary and political ideas of Bilbao was Eusebio Lillo (1826–1910). Editor, poet and soldier, he wrote fervid patriotic poetry, some of which is still popular in Chile, among these being the 'Himno nacional' and the 'Himno de la igualdad.' Another active literary and political figure of this period was Isidoro Errázuris (1835–). He distinguished himself in the field of history, which deals altogether with Chilean affairs. Guillermo Blest Gana (1829–1904) is a very subjective poet with decidedly romantic leanings. He has been called the poet of the home. Guillermo Mata is the most representative Chilian poet of the middle of the 19th century. He fitted his muse to political and national ends and he had admirers throughout Latin America. Among his extensive poetical publications are 'La mujer misteriosa,' 'Un cuento endemoniado,' 'Cuentos en verso,' and much heroic and historical poetry. Martin José Lira (1833–67), one of the best nature poets of Chile, has made numerous translations from English into Spanish, among them Longfellow's 'Psalm of Life.' Luis Rodríguez Velasco, J. A. Soffia, Eduardo de la Barra, the brothers D. A. and J. A. Alemparte and a score of other writers contributed more or less to Chilean poetry.

Uruguay.— The peculiar formation of the great flat country along the Rio de la Plata and the close political and social relationship long existing between Uruguay and the Argentine have made it inevitable that their literatures should act and react upon one another. The constant revolutions in both countries have caused the exodus of literary men from one to the other and from the neighboring republics. The capitals of both republics have formed the hot-beds of revolutionary propaganda and the refuge of political exiles, many of whom were fired with the enthusiasm for political and social reforms each in his respective country. These conditions and circumstances have had an all-powerful influence upon the literature of both countries and in fact upon that of several other Latin-American republics, though probably upon none to such an extent as upon Argentina and Uruguay, many of the literary men of whom have had, at one time or another, to take refuge abroad from evils at home. To this latter class belonged Francisco Acuña de Figueroa (1790–1862). He was a strong partisan of Spanish interests in America and when the colonists rose up in rebellion during the Napoleonic troubles in Europe, he fought the battles of Spain right vigorously, using reason, appeals to patriotism, invective and satire. Naturally, on the success of the cause of the colonists, he had to leave the country, going to Brazil. After a while, he was permitted to return and became most active, as a literary figure. His influence which was nation wide exerted its greatest power in Republican circles. Notwithstanding many public duties Acuña de Figueroa was a voluminous writer, his published works comprising 12 substantial volumes. In 'La Malambrunada,' one of the best-constructed and worked-out satires in the Spanish language, he ridicules the exaggerations and pretensions of the new school. In 'La Madre Africana' Acuña de Figueroa pleads for the abolishment of the African slave trade; and in others of his poems he displays a constant and intelligent interest in the great public questions of his day. Melchor Pacheco y Obes (1810–57) was, in a sense, a precursor of the Romantic school of literature. Pedro P. Bermúdez (1816–60), a poet of some power, is noted for his lyrical drama 'El Charrua,' which met with signal success on account of the sentiments it expresses, its sympathy with the native races and America as opposed to Spain. Adolfo Berro (1819–41), a still more determined follower of the Romantic school, selects for his poems, for the most part, native subjects and incidents and he evolves his story with considerable skill and marked interest. Juan Carlos Gómez, a lyrical, romantic poet with strong subjective and personal tendencies, made his power felt in journalism and politics. He is intensely patriotic and he displays a fierce hatred of Brazilian domination over his country. On this subject he devotes a long poem of six cantos, 'Figueredo.' Alejandro Magarinos Cervantes (1825–93), diplomat, poet, dramatist and novelist, is the most universal literary genius that Uruguay has produced. He early acquired literary fame not only at home but throughout Latin America and Spain. He published, during his student days in Madrid, a novel of considerable force and great promise, 'La estrella del sur' and two dramas, 'Amor y patria' and 'Percances matrimoniales,' which increased his reputation. When, at the age of 27, he published his poem 'Celiar,' a striking legend of epic qualities, his name was already well known throughout Spain. Crowned with European laurels he returned to his native country at the age of 30. There during the rest of his life he retained the enthusiastic admiration of his countrymen who heaped favors upon him, among them being the position of rector of the national university and senator. Among his more notable works are 'Brisas del Plata' (1864), and 'Palmas y Ombúes' (1884), two volumes of poems of various kinds, all of which are marked by a choice of native subjects, an intense love of his native land and the power of painting the life about him superior to that of any of his contemporaries or of his countrymen up to his day. Of his various novels, 'Caramurú' is the best from the point of view of construction and general development. Francisco de Acha (1828-88), journalist, poet, humorist and dramatist, wrote very good comedies, several of which were very successful on the stage. He also edited a comic satirical paper, *El Molinillo,* which had a very wide circulation. Among his successful dramas, some in prose and others in verse, were 'Bromas caseras,' 'Como impieza acaba,' 'La fusión' and 'Una victima de Rosas.' Heraclio Farjado (1833-70), poet and dramatist, was one of the most popular literary men in Uruguay in his day. He possessed considerable dramatic talent and wrote excellent shorter poems and odes. 'Arenas del Uruguay' contains most of his shorter poems; and his most noted longer poetical composition is 'La cruz de Azabache.' For his ode on 'América y Colón' he won a gold medal in 1858. His best-known drama, 'Camilia O'Gorman' (1836), was received with great enthusiasm, perhaps more on account of its political references than because of the evident dramatic talent which it shows. Victoriano E. Montes (1848-) belonged to the group of poets who delighted in depicting the life of the interior of the country after the manner of the gaucho poets. His best productions, which possess a very considerable warmth of feeling and action, are 'El Tambor de San Martín' and 'Tejedora de ñandutí.' To this period belong two dramatists who were quite popular, Estenilaso Pérez Nieto and Orosman Moratorio. The chief work of the former, 'Apariencias y realidades,' has its scenes laid during the revolutionary period. Moratorio, in his dramas, successfully exploited the gaucho character, surroundings and associations, working over popular legends and stories. His dramas are still occasionally presented. Washington P. Bermúdez (1847-) came by his dramatic talent through family inheritance, his father being Pedro P. Bermúdez, already mentioned. He contributed fugitive verse to the periodicals; and became known as a writer of witty, satirical and political poems, many of which were contributed to *El Negro Timoteo,* a noted political journal. He wrote many plays, the most successful of which was 'Artiagas,' a historical drama, which is looked upon as one of the literary assets of the nation. Juan Zorilla de San Martín (1857-), diplomat, lyrical and epic poet, and the leader and greatest representative of the Romantic movement in Uruguay, was educated in the University of Chile and there received the first inspiration in the Romantic literature which had then already taken hold on the Pacific coast. He took ardent sides with the struggle then going on between the older school and the new literary movement; and he began to write with enthusiasm and yet with great care. Inspired with the ambition of writing the great Latin-American narrative poem, he set to work on what proved to be the greatest poem of its kind in Uruguayan literature. This, when published, bore the title of 'Tabaré,' the name of the hero of the story. The poem, which consists of six cantos, sings, in beautiful lyrical verse, the love story of Tabaré, half-breed Charru Indian, for Blanca, the sister of Don Gonzalo, the Spanish commander. The plot ends in a tragedy, which was in reality the only solution for the complications the author had created. Among the other works of San Martín are his famous 'La Leyenda Patria,' 'La epopeya de Artigas' and 'Resonancias del Camino.' Luís Piñeyro del Campo (1858-) marks the passing of the Romantic movement into quasi-realism. He has written a great deal that is pleasing and often poetic, but little that is really lyrical or approaching poetical greatness. His 'El último gaugho,' one of his longest poems, gives a pleasing picture of the past and its customs. Santiago Marciel (1867-), at the age of 17, published a volume of poems which gave great promise of future achievement ('Auras primaverales'). His best-known long poem, 'Flor del trébol,' a tale of love, war and adventure, displays considerable poetic feeling and an appreciation of the beauties of nature. Among the other poets of Uruguay worthy of notice are Bernardo Prudencia Berro (1803-68), Enrique de Arrascaeta, Joaquín de Salterain, Antonio Lussich, Luis M. Lafinur, José del Busto, Victor Arreguine, Rafael Fragueiro and Carlos Roxlo. The latter, who is a poet of considerable versatility, has written what is by far the best literary history of his country, 'Historia crítica de la literatura uraguaya' (1912). The same subject has been treated, but in a much less efficient and extensive manner, by Francisco Bauzá, in his 'Estudios literarios' (1885).

Eduardo Acevedo Díaz (1851-), journalist, soldier, reformer, critic and novelist, stands easily at the head of the story writers of Uruguay. He passed a stormy life. Frequently in opposition against the government and often in arms and exile, his varied experiences are embodied in a series of novels of startling reality and dramatic force. Undoubtedly Acevedo Díaz was largely influenced in his earlier days by his companion in exile, Carlos María Ramírez, author of 'Amores de Marta,' a popular romantic story, and other tales. Among Acevedo Díaz' popular stories are 'Brenda,' his first novel; 'Ismael,' 'Nativa,' 'El Grito de Gloria,' a trio of semi-historical novels, purporting to relate the adventures of a family during the wars of the revolution, which present a bewildering array of excellently drawn characters. Carlos Reyles (1862—) is credited at home with being the leader of the naturalistic movement among the novelists of Uruguay. He had unexceptional facilities for depicting the life of the interior of the republic, for he was the owner of an extensive cattle ranch on which were employed scores of cattlemen and other ranch help. These he studied carefully and in detail; and he has reproduced them with startling exactness. Among his best and most realistic stories are 'Beba' (1894); 'La raza de Cain'; and a volume of excellent short stories. Manuel Bermúdez (1867—) also has written very good stories after the style of Reyles.

Uruguay has also produced good dramatists in Samuel Blixen (1869–1909) and Victor Pérez Petit (1871—). The former has developed, in a series of plays of the seasons, 'Primavera,' 'Otoño' and 'Invierno,' some very fine characterization. Pérez Petit has written, in addition to drama, literary criticism, stories and tales. His literary criticisms and studies include 'Los Modernistas' and 'Zola,' and his dramas 'Cobarde,' 'Yorick' and 'El Esclavo-rey.' He also published poems and a volume of sonnets bearing the title 'Joyeles bárbaros.' Two modern Uruguayan poets are Julio Herrera y Reissig and José Enrique Rodó. The former possesses marked poetical talent; his best work is to be found in his sonnets which received a sort of second birth after the death of the author in 1909. Rodó is learned and is looked upon as a leader of a certain section of the modern literary field not only in Uruguay, but also in the Argentine and Paraguay.

Peru and Bolivia.— Away back in semi-historical times Peru and Bolivia were connected politically and their interests have been, in many respects, very closely related since then. Bolivia, owing to the disturbed condition of the country following the expulsion of the Spaniards, did not begin to produce literature until about the middle of the 19th century; and since then, her writers have, for the most part, been but rather faint echoes of those of Peru and the other surrounding countries, and of Spain. Therefore the literary efforts of Peru and Bolivia have been grouped together in this article.

Peru.— In Peru the unsettled condition of the country following the achievement of independence retarded literary development; but still the ancient land of the Incas recovered more quickly than her one-time province, Upper Peru (Bolivia). Manuel A. Segura (1805–71) is the brightest literary star on the horizon of Peruvian Republican literature. His first comedies began to appear in 1839. His published comedies numbering a dozen are witty, full of intrigue, have considerable movement and present very good characterization. Hence they were very popular in their day. Among the best of his comedies are 'La moza mala'; 'Saya y manto'; 'Lances de Amancaes,' 'Na Catita'; and 'El Sargento Canuto.' Felipe Pardo Aliaga (1806–68) was, like Segura, a depictor of the humorous situations of life and a wielder of satire. They are very good pictures of certain phases and conditions of the life of the country and of the society of the day. Among Pardo's best-known comedies are 'Frutos de la educación,' 'Don Leocadio' and 'Una Huérfana en Chorillos.' Manuel Castillo (1814–70), leader of the mountain school of Arequipa, is a poet with a great love of nature and a power of depicting her moods. To this period belongs Juana Manuela Gorriti de Belzu (1819–74), the greatest woman writer of Peru and her most clever novelist. Her husband, Manuel Bezu President of Peru from 1848 to 1855 and again in 1865, died in the latter year at the hand of an assassin. Juana Manuela Gorrita had published her first novel, 'La Quena,' in 1845 and had followed it up with many tales of a like nature, all having a historical or legendary basis in the national life of Peru and her pre-Spanish civilization. A collection of her stories was published under the general title of 'Sueños y realidades' in 1865; and since then various other editions have appeared. Juana Manuela Gorrita also edited a periodical, *El Correo del Perú,* which exercised very considerable influence in literary circles. José Arnaldo Márquez (1830–1904) wrote in a fatalistic and hopeless vein which gained him a considerable following. He struggled all his life with poverty and inability to make a decent living and his struggle is vividly reflected in his 'Meditación' and other poems. Carlos Agusto Salaverry (1831–90) is the Peruvian poet of melancholy and yearning love. There is in his poems a sweetness and depth of feeling rarely attained in Latin-American literature. 'Cartas a un ángel' contains a collection of his love poems. Ricardo Palma, critic, historian, philologist and poet, made a very respectable body of literature out of the traditions, customs and humors of Peru and Peruvian life. No other Latin-American writer has handled so many characters, incidents and plots as Palma has in his 'Tradiciones Peruanas' which were published in various series and numerous volumes. Clemente Althaus (1835–81) has attempted almost every class of literature, passing from Romanticism in his younger days to Classicism in his more mature years. He wrote much and passably well. Luís Benjamín Cisneros (1837–1904), diplomat and poet, rises above the level of the poetic achievements of Althaus. Among his poems which are recited in schools and colleges and at private gatherings and public assemblies in Peru, are 'Al Perú' (1860); 'Aurora Amor' (1885); and numbers of his songs and his patriotic odes. Manuel Nicholás Corpancho (1839–63) who died in the burning of a ship at sea was one of the most promising of Peruvian poets. Owing to his poetic success he had already been appointed Peruvian Minister to Mexico at the age of 21. He was both dramatist and lyrical poet. His first drama, 'El poeta cruzado,' published at the age of 17 is a surprisingly good production. Among his other works are 'Magallanes,' an epic poem founded upon the life of Magellan. A collection of his poems with an introduction by José Mármol appeared under the title 'Ensayos poéticos.' Pedro Paz Soldán y Unánue ("Juan de Arona," 1839–95), a poet of much originality and power, occupies a high place in the estimation of his countrymen. In his periodical, *El Chispazo,* he poured out all his satire, sarcasm and bitterness, which, natural with him, was imitated by the younger poets of his following. Paz Soldán made extensive translations from Virgil, Lucretius and Ovid; and this helped to increase the beauty and effectiveness of his style and the strength of his imagery. At once the most characteristic and the best of his published works is 'Cuadros y episodios peruanos' (1867). In these pictures, for such they really are, Peruvian scenery and life, especially in the country, seem to live and breathe. Ricardo Rossel (1841–1909), a poet of high ideals and Romantic tendencies, forms the link between the Romanticists and the Modernistas. Rossel has attempted successfully, in addition to Romantic poetry, the historical legend, songs, letrillas and humorous verse. Two poems which show the extremes of his composition and treatment are 'Hima Sumac,' a poetical historical legend, and 'Meditación en el cementerio.' Manuel González Prada (1844–), professor of literature, possessed of a mastery of Spanish composition, has run through all the gamut of extremes, pessimism, atheism, anti-religious fanaticism, anarchism, and yet preserved his beauty of style and perspecuity of thought and arrangement. His most characteristic work is ‘Páginas libres.’ Carlos G. Amézaga (1846–1906), dramatist and poet, in his ‘Leyenda del Caucho’ has shown considerable epic ability and his ‘Más allá de los cielos’ has the true lyrical ring. Clorinda Matto de Turner (1854–), the Peruvian wife of an English doctor, is noted for her patriotic poems. She has written two series of good "tradiciones," and a novel, ‘Aves sin nido,’ the latter of which has been extensively read throughout Latin America. It depicts, in a powerful and convincing manner, the wretched condition of the native Indian ground down beneath the heel of the landowner, the Church and the government. Peruvian critics are fond of comparing ‘Aves sin nido’ with ‘Uncle Tom's Cabin.’ Contemporary with Clorinda Matto is Mercedes Cabello Carbonero, another clever Peruvian writer and the best novelist her country has produced in her own peculiar field, the depicting of Peruvian society. She has covered a wide extent of territory in her novels. Political ambition and its effects upon the country, gambling and its effect upon society, the relation of women to society and many other like subjects she has made the centre themes of her novels which are still read not alone in Peru but in many of the other Latin-American countries. Among her most popular novels are ‘El conspirador,’ ‘Las consecuencias’ and ‘Blanca Sol,’ the latter of which is almost as well known in Spain and throughout Latin America as at home in Peru. Jóse Santos Chocano (1875, q.v.), the exponent of Americanism, is universally and favorably known through Latin America. Among his published works are ‘Iras santas’ (1894); ‘En la aldea’ (1895); ‘La epopeya del Moro,’ ‘Alma America’ and ‘El canto del porvenir.’ Among the minor poets and writers of Peru worthy of mention are Clemente Palma (son of Ricardo Palma), noted for his ‘Cuentos malévolos’; Jóse Gálvez, a writer of erotic sonnets and epic poems; Juan del Carpio, a poet of love songs and other erotic poetry; Leonidas N. Yerovi; Enrique A. Carrillo, a novelist; Manuel Bedoya, a dramatist of very modern tendencies; Felipe Sassone, a poet of love themes; José de la Riva Agúero, historian and critic, whose ‘Character de la literatura del Perú independente’ is one of the best works on the subject; and Francisco Garciá Calderón, essayist, historian and philosopher. The latter is one of the best of the Latin-American writers in his peculiar field and he is favorably known in Spain and throughout Latin America. He has dealt extensively with the problems of his country and with those of Latin America in general. Among his works that are generally known are two published in French, ‘Le Pérou contemporain’ and ‘Democraties latines de l'Amérique’; and two issued in Spanish, ‘Profesores del Idealismo’ and ‘Hombres e ideas de nuestro tiempo.’

Bolivia.—Among Bolivian writers who have made respectable places for themselves on the literary roll of their country is Nestor Galindo (1830–65), a somewhat melancholy poet of Romantic tendencies. Undoubtedly he stands higher in the eyes and in the hearts of his countrymen, because he was exiled from his native land several times, and finally shot. His chief work is ‘Lágrimas.’ Daniel Calvo (1832–80), a contemporary of Galindo, seems to have been under the same influence as the latter; and his attitude toward life is seen in his first volume of poems, ‘Melancolías.’ In fact he was an ardent admirer of Galindo and addressed some poems to him which fully display this admiration. His ‘Rimas’ are better and more varied than his other work; and some of the romantic legends contained therein have been popular in Bolivia. Rosendo Villalobos (1860–) has spent more time out of his native country than in it; and while he is claimed by Bolivia as one of her clever literary men, he more properly belongs to the city of Lima where most of his literary work has been produced. There he published several volumes of poems, light in quality, but possessing a sympathetic touch and a swing which make them pleasant reading. They have, therefore, been quite popular in both Peru and Bolivia. Numbers of other Bolivian writers are scattered throughout Latin America because of the want of encouragement at home. One of these, Ricardo Jaimes Freyre, a professor of literature in Tucumán, Argentina, has made for himself an international reputation as a follower of the Modernista movement. He is a disciple of Rubén Darío, with whom he was at one time associated. Benjamín Lens (1836–78) was a follower of the Romantic poetry whose influence had already extended to all Latin America in his day. He, Galindo and Calvo are usually associated together in any review of Bolivian literature. Lens, however, is free from the excessive lachrymose tendencies of his two literary companions. He is, therefore, more pleasant reading, though he has not the poetic touch of Galindo nor the facility for successful imitation of Calvo. The modern poets of Bolivia are all under the influence of Rubén Darío, Santos Chocano or some one or all of the prime actors in the Modernista movement. Of late years, however, Chocano has come to have more influence in Peru than Darío or any other modern or ancient poet. The Pan-American note of Chocano finds an echoing voice and a sympathetic ear in Bolivia. This Chocano influence is having a good tendency on the younger generation of Bolivian writers who promise to make themselves heard in the near future in the cause of the extension of the feeling of common interests and brotherhood throughout the American continents.

Colombia.— For its population and the extent of its educated class Colombia has produced more literary men, in its short national life, than perhaps any other of the Latin-American republics. Among the early writers of republican Colombia are José Joaquín Ortiz (1814–92) and José Eusebio Caro (1817–53), both poets, magazine writers and editors who worked together earnestly and intelligently for the advancement of Colombian literature. The latter is very strongly subjective and sensitive, vehement in his likes and dislikes, lyrical and oratorical, and he moves ever on a high plane of morality and duty. Ortiz, too, belongs to the Romantic school, and his poetry shows power of description, choice of words, finish of form and a lyrical ring which, at its best, is very good. His patriotism and his literary culture ring true and enabled him to do much, during his long and active life, for the cause of letters in his native country. A contemporary poet of great talent was Julio Arboleda (1817–62), statesman, soldier and patriot. Born to considerable wealth, his life was one long series of adventures and political changes, which finally ended in his assassination. His geatest work, ‹Gonzalo de Oyón,› a long poem founded on a native legend, is written in excellent Spanish, and displays many attractive poetical gifts. Its influence has been very considerable on subsequent Colombian literature and his work is still read throughout Latin America. One of the most voluminous writers of Colombia was Manuel María Madiedo (1817–1900). His varied writings cover science, law, government, logic, poetry and religion; and there is a strong patriotic ring to them enforced by an enthusiastic love of nature. He was also a journalist and dramatist. One of the poets of this period who strongly reflected the Romantic movement was Gregorio Gutiérrez González (1826–72), «Antioco.» There is a tone of melancholy and discouragement running through his poems which appealed strongly to his audience and made him one of the most popular poets of Colombia. Felipe Pérez (1834–) and his brother Santiago (1837–) both wrote dramas, some of which were acted with success and others of which were simply published as literary productions. Felipe found the plots for his novels and tales in the early history of Spanish America, while his brother sought his in English history. José María Samper (1828–98), diplomat, dramatist, novelist and biographer, is one of the foremost figures in Colombian literature. He was a prolific dramatist, averaging over three plays a year for some time, all of which were staged, some of them with notable success. Turning from the stage he wrote novel after novel, interlarding his work with sketches of his contemporaries and of other native literary men. Among his best dramas are ‹Dos Primos a la Moderna› and ‹Un Alcalde a la antigua.› His ‹Historia de una alma,› largely autobiographical, is a book of deep interest. One of the most interesting characters in Colombian literature is Rafael Nuñez (1825–94). At the age of 36 he was President of Colombia, and for a score of years he dictated the policy and government of his country. Beginning as a confirmed skeptic, he gradually came around to protect the Church and he rose from a dictator to an advocate of something as near like constitutional government as Colombia was fitted for at the time. In addition to poems he has written a very interesting work, ‹La Reforma política en Colombia.› José María Vergara (1831–72), poet, literary critic and editor, did much for the advancement of Colombian literature; and his ‹Historia de la literatura en Nueva Granada› (1867) is the best authority on the subject. José Manuel Marroquín, statesman, philologist, political writer and historian, was successively Vice-President (1898–1900) and President (1900–04). His wörks interestingly reflect the life of his times. Miguel Antonio Caro (1843–1909), another Colombian President, was a classical poet; encouraged literature and edited, among other works, Arboleda's poems. Diego Fallón (1834–1905), a poet of breadth and imagination and depth of feeling, stands high in Colombia as a writer of rhythmic poetry that is, in some ways, suggestive of Poe. His religious sentiments and love of nature are ever strongly in evidence in all his work. Rafael Pombo (1833–1912), diplomat, educator and poet, is still one of the most popular of Colombian writers. His poetry is versatile, imaginative, rhythmic, technically excellent; and it often expresses great depth of feeling. Among his many popular poems are ‹Mi Amor,› ‹Angelina,› ‹Cuentos morales› and ‹Cuentos pintados.›

Colombia has produced many novelists, the best of whom are Jorgé Isaacs (q.v., 1837–95) and José María Samper already mentioned. Isaacs' ‹Maria› is the best novel written in Latin America. It has been translated into most of the languages of Europe and has been warmly received in Spain. The book constantly reveals an intensity of passion that is truly Latin-American. Isaacs also published a volume of poems of some merit but inferior to his novel. He has had many imitators in his own country, the best of whom is Lorenzo Marroquín, who has written some clever stories which have attracted attention at home and abroad. Of these the best known and most discussed is ‹Pax.›

Among the more recent Colombian poets who have influenced Latin-American literature through originality in meter and form is José Asunción Silva (1860–96).

Ecuador.— Gabriel García Moreno (1821–75), twice President of the republic (1861–65 and 1869–75) was the leader of the ultra-Catholic party in Ecuador and his administration was very much of a dictatorship. He possessed a curious combination of talents. He was ardently attached to the mysticism of the Middle Ages, and his writings, especially his journalistic work and his ‹Defensa de los Jesuitas,› are of great interest as reflecting the condition of Ecuador during its period of development toward more democratic ideas. The most interesting literary character of Ecuador is Juan León Mera (1832–99), poet, novelist, critic, historian, scholar and antiquarian. But it is as a poet that he is best remembered. One of the best of his longer poems is ‹La virgen del sol› (1861). Odes, romances, Indian legends, love poems and songs give a great deal of variety and life to his whole body of poems. Mera's ‹Historia Crítica› of the literature of Ecuador is one of the best works of its kind; and his editions of the works of various Latin-American poets give strong evidence of his critical ability. Mera also won fame as a novelist, his best work in this department of literature being ‹Cumandá› (1879). This story displays a great love for and familiarity with nature. In it the poet shows that the forest is his domain and his great love. Numa Pompilio Llona (1832–1907), educator, poet and philosopher, who received an excellent, cosmopolitan education in Colombia, Peru and Ecuador, and spent some years in the diplomatic service of his country in Europe, wrote long, semi-philosophical poems and sonnets which were popular in his day; but they are too discursive and subjective to suit the popular taste of to-day. Some of his poems, however, like ‹Noche de dolor en las montañas,› ‹Los caballeros del Apocalipsis› and ‹La Odisea del Alma› are still popular in

Ecuador. Juan Montalvo (1835–89) is one of the most unique of Ecuadorian literary men. Profoundly religious, he was a strong hater of everything that gave evidence of sham in society, government and religion. This hatred burned fiercely against the friars and the ignorant clergy of his country who prostituted their office. His mind was brilliant and original and his forms of poetical expression distinctively his own. Among his works are 'El Buscapie' (partially finished); 'Siete tratados,' 'Cervantes,' and considerable excellent literary criticism, much of which appeared in his quarterly, *El Espectador*. Like most Latin-American countries, Ecuador possesses a very considerable number of aspirants for poetical honors, the greater number of which, however, sing in a minor key. Among these are Luís Cordero, Dolores Veintemilla de Galindo, Julio Zalumbide, Horacio Vásquez, Francisco Campos, Alejandro Andrade Coello, Carlos R. Tobar, Emilio Gallegos del Campo, Dolores Sucre and Emilio Gallegos Naranjo.

Venezuela.— On the breaking out of the revolution which finally led to the separation of the country from Spain, the Venezuelan revolutionary leaders had only one use for the press, and that was to employ it to fight Spain. This end was purely political. Hence the volume of political literature which marks the beginning of the life of the young republic. But even at this early date some enthusiastic spirits began the cultivation of literature for its own sake. These literary devotees were encouraged by the establishment of the first printing press in Venezuela in 1806; through revolutionary activity; the smuggling into the country of books forbidden by Spain and the general intellectual activity which proclaimed the coming of the revolutionary storm. Among these early literary advocates and lovers were José Luís Ramos, José Sanz, Luís Javier Ustáriz and Francisco Javier Ustáriz who are now remembered more for the encouragement they gave to literature and the example they set than for the excellence of their literary remains. Andrés Bello (q.v.), the greatest name in the literary life of Venezuela in the early days of the republic, became more intimately connected with Chile (q.v.) very early in his career. Romanticism early made its appearance in Venezuela, as it did in all the Latin-American republics. Its first standard bearer was José Antonio Martín (1804–74). True to the inspiration of poetry in Venezuela he sang the beauty of the rich tropical land about him. To him nature was altogether lovely. He also wrote pleasing narrative poems and political effusions which were not so happy because they were not the natural expression of the author who couched them in characteristic Gongoristic language. One of his best poems is 'Canto fúnebre'; and one of his most characteristic and curious narrative tales is 'El Máscara.' Fermin Toro (1807–65), diplomat, educationalist, statesman and poet, has the peculiar distinction of being both a classical writer and a romanticist. He was one of the best diplomatists which his country has produced and he negotiated important treaties between Venezuela and Spain, France, Italy and Great Britain and was instrumental in obtaining general official recognition in Europe of the independence of Venezuela from Spain. Though he was successful in classical poetry he was the first to recognize the fact that in his own country was a wide and interesting field for poetic efforts; and he himself lead the way in his elegies 'Hecatofonia' which depict the cruelty of the Spaniards in their treatment of the natives of Venezuela. His poetical tales have less merit than some of his other works. Rafael María Baralt (1810–60) has the distinction of being the first Venezuelan literary man who was welcomed in Madrid where he became one of the noted literary figures of the Spanish capital and a member of the Spanish Academy. He distinguished himself in various fields of literary endeavor. Journalist, poet, historian, critic and lexicographer, he proved almost equally efficient wherever he turned his hand. He was a great lover of classical literature and he saw the dangers into which the Romantic school was running. His sonnets and odes are among his best work; yet they are too often rigidly classical. The best known of his odes, and probably the most meritorious, is his 'A Colon,' which is known to every Venezuelan who knows anything about literature. Juan Vicente González (1808–66), historian, essayist and biographer, is one of the deepest thinkers and best critics that Venezuela has produced. In his 'Historia Universal' and his 'Mesenianas' are striking elegies in prose about the men who gave their lives for their country. José Ramón Yepes (1822–81), sailor, poet and soldier, has written poems that are filled with fine descriptions of the sea to which his vivid imagination and his sensitive poetical nature have lent great brilliancy. The most notable Venezuelan poet of patriotic verse is Abigail Lozano. Journalist, critic and lyrical poet, he has done good service in advancing the cause of literature in Venezuela through his literary publication, *El Album*. Among his collections of poems are 'El martirio' (1847), and 'Otras horas de martirio' (1864). Many of his poems have a political trend. Daniel Mendoza (1823–67), journalist and successful humorous writer and satirist, has made the vehicle of his satire on the customs, manners, foibles and extravagance of the larger cities the "llanero," or Venezuelan cowboy. The latter, who has but recently arrived in the capital, is constantly surprised at all that he sees there, and he makes his comments accordingly, thus holding up, apparently innocently, the vices of the age. José Antonio Calcaño (1837–97), a romantic poet of some considerable power, but no apparent aims in his work, has been popular in Venezuela. One of his best poems, 'A orillas del Tamaira,' is filled with very pleasant pictures, but spoiled by his constitutional repining over the things and advantages lost in the past. As it is there is a haunting sweetness and caressing melody in many of his plaints; as for instance in 'La maga y el genio de las selvas' and 'La hoja.' Another Venezuelan poet of nature is Heraclio de la Guardia (1829–1907). He has written poems on many kinds of subjects and has a large body of work to his credit, some of it, however, of a somewhat mechanical nature. One of the most popular and national of Venezuelan poets is Domingo Ramón Hernández. He is a follower of the Romantic school and he catches its inspiration and real sentiments perhaps better than any other Venezuelan. There is a depth of sweetness and tenderness, a wealth of imagery and an undertone of sadness in his poetical efforts that have endeared him to his countrymen. Francisco G. Pardo (1829–82), one of the most persistent prize winners of the Venezuelan Academy, has been called the Longfellow of Venezuela. Among his popular poems are 'Las Indianas,' 'El porvenir de la América' and 'La gloria del libertador.' Cecilio Acosta (1831–81), jurist, orator, journalist and poet, had the power of poetical repetition so noticeable in the songs, poems and oratory of the aboriginal races of America. Some of his poems read like an echo of 'Hiawatha' or of some of the songs or hero tales of the Iroquois or Algonquins. He was one of the cleverest masters of word painting in the history of Latin-American literature. A very characteristic example of his style and his limitations is 'La casita blanca.' Being a noted orator, Acosta was naturally a master of prose composition. In fact his prose has often all the characteristics of his poetry. It is rhythmic, imaginative and forceful. 'La gota de rocio,' one of his best poems, possesses much of the mannerism of his best prose efforts and effects. Nicanor Bolet Peraza, journalist, political agitator, reformer and dramatist, was at one time well known in the United States, where he spent most of his life in political exile. He was witty, satirical and yet withal possessed of a strong fund of common sense and the ability to size up the situation in all cases. He strove sedulously to induce the different republics of Latin America to follow the example of the United States in the adoption of democratic principles and practices. His writings have always been popular in Venezuela with a large percentage of the people, and his play 'Luchas de honor' received an ovation in the capital of that republic. Julio Calcaño (1840—), philologist and novelist, was tireless in his efforts in the field of literature and in his endeavors to inspire his countrymen with a desire to improve and broaden that field. His historical novel, 'Blanca de Torrestella,' which has run through several editions, and which has been translated into English and French, was popular in Europe and America. No other Venezuelan writer has painted such vivid pictures in prose of his country as has Julio Calcaño. This is because he knew Venezuela as few Venezuelan writers have succeeded in knowing it. His great work 'El castellano en Venezuela' has become a classic for those who are interested in the study of the Spanish language in Latin America and its relation to the tongue of the mother-country. Juan Antonio Pérez Bonalde (1846–92) made popular in Venezuela the poetry of Becquer who received his inspiration from Heine. Pérez Bonalde has often more of the ring of the German than has Becquer himself; but generally his poetry falls considerably below that of either Heine or his adapter. Pérez Bonalde's importance consists in the fact that he introduced his countrymen to Becquer and put them in line with a wave of literary effort which was destined to spread over all the republics of Latin America and to leave deep and lasting effects, one of which was that it, in part at least, was the cause for the appearance of the Modernista movement on the American continents. Pérez Bonalde's German influence is due to the fact that he was a very close student of the German language and literature and especially of the poems of Heine of whom he was an ardent admirer. His 'Estrofas' (1877) was largely composed of translations or adaptations from the German poet. Some of his original work is of high standard and possesses the qualities which he admired so much in Heine and Becquer. These qualities are seen at their best in 'Poema del Niágara,' which was translated into sonorous English by the American poet Bryant, who had a high appreciation of the talent of Pérez Bonalde. 'Vuelta a la patria' is another poem of Pérez Bonalde which is known wherever the Spanish language is spoken. Among the followers of Pérez Bonalde and, through him, of Heine and Becquer, is Miguel Sánchez-Pezquera (1851—). He is both an erotic poet and a writer of Heine verse to which he has given an original turn by applying the moralizing principles of Heine to historical and dramatic settings. He is fond of moralizing on the vanities of all things human, on the shortness of human life and on the hopelessness that ofttimes takes possession of him. Of this class of composition is 'El último pensamiento de Weber' and 'La tumba de Marino.' A reactionary poet who flourished in the midst of Romanticism is Manuel Fombona Palacio (1857–1903). He was as careful in his composition as the most pronounced disciple of the classical school. His poetry shows considerable vision and historical perspective; but it is too often suggestive of the atmosphere of the past than the forward movement of the present. His 'Hanibal ante portas' is a vivid picture of the conditions existing in Italy and the fear in Rome at the news of the latest triumphs of Hannibal. Many of his classical poems are of like value. Manuel Pimentel Coronel (1863–1907) has written a great deal of pleasant narrative verse which is often, however, frequently spoiled, because of the author's tendency to preach or to impart some lesson. His poems are easy to read because they are generally kept within the understanding of the masses and, for this reason, they have been more largely read than they otherwise might have been. Gonzalo Picón Febres (1860—), poet, short-story writer, novelist and literary critic, is one of the most important of the modern Venezuelan writers. He has manfully and effectively taken up the cudgel in behalf of the criollo in Venezuela; and his pictures of Venezuelan customs, habits and society are as vivid and as interesting as any contained in Isaacs' 'Maria.' Picón Febres' work naturally divides itself into two distinct parts, the first of which embraces his early poetical efforts and the second of which begins where the author came under the influence of Heine, Becquer and the Becquerista school, already on a pretty sure footing in Venezuela. To this first period belong 'Caléndulas' and 'Claveles encarnados y amarillos,' two volumes of verse of a decidedly classical trend. The second period begins with the publication of tales of a very realistic type. These were followed by novels in which the author exhibits his talents much more highly developed. Among these are two which have attracted attention throughout Latin America and in Spain, ‘Nieve y lodo’ and ‘El sargento Philipe.’ The latter is the best of his work. It is a novel filled with interest from cover to cover, and this interest is connected together with the most vivid and convincing pictures of life in Venezuela. Like so many Latin-American and Spanish novels and stories, however, it is hopeless tragedy. One of the latest works of Picón Febres, who is by the way a university graduate and a deep student of science, is the ‘Libro raro,’ a wonderfully interesting work on the peculiarities of Spanish as spoken in Venezuela. It is a work written to supplement and correct the ‘Catellano en Venezuela’ of Calcaño, already mentioned. Another book which shows the breadth of learning and critical power possessed by Picón Febres is his ‘Literatura venezolana en el siglo XIX,’ the most learned and extensive work of its kind on the subject in Spanish. José Gil Fortoul (1860—), historian, short-story writer, essayist, critic and novelist, began his literary life as an out and out adherent of the French psychological writers and more especially of Paul Bourget. But he outgrew his youthful tendency and influence and became the most interesting and soundest historian of his country. His first story to attract attention, ‘Julián,’ is said to be largely autobiographical, and his French influence stood him in fairly good stead as it enabled him to analyze the conditions under which his hero is supposed to have lived, and incidentally to reveal his own thoughts and the influences at work in his own life. A succeeding story, ‘Idilio,’ was subject to much the same influences, but it is weaker in plot and development than the former novel. ‘Pasiones,’ another novel, is also partially autobiographical at least. It is a vivid picture of political conditions in Venezuela under Guzman Blanco's dictatorship. Pédro César Dominici (1863—) has written very good tales, but they are all foreign to the soil in that they have nothing whatever to do with Venezuela or things Venezuelan; for Dominici seems to have never been in sympathy with his country. Manuel Romero García (1865—), on the contrary, has written so intimately about Venezuela and things Venezuelan that he is often so wrapped up in his subject he gives to it details and allusions an outsider cannot understand on account of their pure localism. These characteristics are very prominent in Romero García's novel ‘Peonía,’ which the author himself has declared is a photograph of social conditions in Venezuela, more especially in the rural sections. This novel, which was very popular, gained for the author a considerable following of younger writers who began to exploit what was known as the nationalistic movement, which had already gained headway in the Argentine and several other Latin-American countries. It became the fashion to write stories about Venezuelan characters and subjects and the short tale in this field found a number of exponents, among them Rufino Blanco Fombona, Luís Ubaneja Achelpohl and Rafael Bolívar. Of these the best known is Blanco Fombona, novelist and critic, who has lived mostly in Europe, where he has been very closely connected with the Modernista movement. His tales and stories have had a wide circulation in Europe in both Spanish and French. Among his poems is a volume bearing the title ‘Pequeña ópera lírica’ (1904). He has also published numerous volumes of sketches and travels, among them ‘Más allá de los horizontes’ (1904) and ‘La Lámpara de Aladino’ (1915). A close friend of Rubén Darío (q.v.), Blanco Fombona became one of the most active of the Modernista poets and the foremost representative of that school in Venezuela. His ‘El hombre de hierro,’ a satire on conditions in Venezuela during the dictatorship of Cipriano Castro, is a novel of very considerable force and power of description and of depicting conditions and characters. It grew out of the author's personal experience while governor of the Amazonas territory (1905). While in prison in Venezuela Blanco Fombona wrote ‘Cantos de la prisión y del destierro’ (1911) which have become popular with the Venezuelan revolutionary element. He has also written a great deal of sane criticism about Latin America and other literature; but his weak point is his antipathy to the United States. Miguel Eduardo Pardo (1868–1905) has caricatured the Modernista movement and the whole school of writers who have written so fervidly about Venezuela, in his ‘Todo un pueblo,’ which has been also printed in Europe and translated into French. Manuel Díaz Rodríguez has taken delight in satirizing conditions in his native land and in many respects he has outdone Pardo in his novel ‘Idolos ratos,’ in which he lashes absolutism in Latin-American politics and government. He is inclined to follow the sociological school, as exemplified in French literature of the latter quarter of the 19th century, in his other novels and more especially in ‘Sangre patricia.’ As an art and literary critic Díaz Rodríguez has no superior to-day in Venezuela, and few equals in Latin America. His criticism is marked by the same rhythmic, forceful and clear prose that makes his novels and other literary productions delightful reading. Among the other Venezuelan minor writers worthy of mention are Francisco de Sales Pérez (‘Ratos perdidos,’ 1880); Nuñez de Cáceres; Jacinto Gutiérrez Col, Andrés Mata; Víctor Racamonde, Samuel Darío Maldonado; Francisco Lazo Martí (‘Silva criolla’); Eduardo Blanco (‘Zárate’); José María Manrique; Tomás Michelena (‘Debora,’ 1884; ‘La Hebrea,’ 1890); Arévalo González, and Rafael Cabrera Malo. For the literature of other Latin-American countries see Mexican Literature; West Indian, Central American, and Brazilian Literature.

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5. LATIN AMERICA AND THE WORLD WAR, 1914–19. The attitude of the Latin-American countries as a whole toward the conflict in Europe can be fully appreciated only when we examine separately the record of each country in this great class during the years of the war. It will, therefore, be our endeavor to present briefly in this article the facts disclosed by studies of action and of tendency, so far as these can be ascertained to-day, in every one of the 20 Latin-American republics. We shall endeavor also to give prominence to things essential and of permanent value, and to show in a true perspective things accidental or transitory. The American republics making common cause with the United States and her allies will be mentioned first. Then those maintaining neutrality — either strict neutrality or a friendly neutrality toward the United States — will be considered in their turn.

Cuba and Panama followed immediately the lead of the United States in her declaration that a state of war existed between the United States and Germany. Thus, on the day after that declaration, the Cuban Congress resolved that there existed also a state of war between Cuba and Germany. President Menocal, in his message to the Cuban Congress, reviewed the causes which brought about hostilities between the United States and Germany. He dwelt upon Germany's continuous violations of international law and of the rights of neutrals, and said: «The Republic of Cuba must not be indifferent to this violation of the rights of peoples nor ignore the noble attitude of the United States. We are bound to that nation by sacred ties of gratitude and confraternity, and by a political treaty explicit and implied which creates between the two nations an understanding practically amounting to an alliance. This would require Cuba's co-operation at any ordinary time, and all the more so now that the United States is defending principles of human liberty, of international justice, of honor and the safety of those free and independent nations which are threatened in their most vital rights and interests.» On 16 Dec. 1917 Cuba declared war on Austria-Hungary. In like manner Panama's acknowledgment of the close political and friendly ties which bind it to the United States was both swift and spontaneous. It has been well said that, to all intents and purposes, Panama has been in a state of war with Germany since 7 April 1917. The President of that republic in his proclamation of 9 April 1917 said: «Panama will lend its full and decided co-operation to the United States of America against any enemies that carry out or intend to carry out any hostile act against the territory of Panama or the Panama Canal or that should in any way affect or intend to affect the common interest of the two countries.» This official document was supplemented by a cablegram addressed to the President of the United States by the President of Panama, in which the latter said: «The Republic of Panama, whose future is so intimately identified with that of the Great American Democracy, will take upon itself, in this trial, the obligation concurrent with its conception of solidarity, and fully assumes on this occasion the responsibilities due to its obligations toward the United States.» On 10 Dec. 1917 Panama declared war on Austria-Hungary.

Bolivia practically reached a decision early in February 1917. The Bolivian Foreign Office, having been advised of the establishment of the submarine «blockade» by Germany, replied that the character of a maritime warfare involving offensive action of submarines against neutral vessels and persons, as well as the prohibition of all neutral traffic within the zone described, constituted an absolute denial of the inherent right of neutral powers to trade and navigate; that in view of this abnormal and illegal situation the government of Bolivia had advised the United States that it was fully in accord with the stand taken by President Wilson, and made common cause with the United States. On 13 April 1917 the German Minister was given his passports. The Bolivian Foreign Office stated that, inasmuch as Germany had carried out to all intents and purposes its threat against vessels and persons of neutral states, and in view of the fact that the steamer *Tubantia* had been torpedoed in neutral Dutch waters, the Bolivian Minister to Berlin being on board, diplomatic relations between Bolivia and the German Empire were no longer possible. On 6 Aug. 1917 the Bolivian President, in his message to the Bolivian Congress, fully endorsed the course adopted by the government of the United States in defense of the principles of humanity and justice.

Brazil's first public statement in connection with her attitude in the European War was almost synchronous with Bolivia's reply, mentioned above; for on 7 Feb. 1917, answering likewise Germany's notification in regard to submarine warfare, the Brazilian government, through its Foreign Office, expressed the desire to maintain its position of unswerving neutrality, reserving, however, the right to present in due time such claims as might arise in concrete cases affecting Brazilian interests. It was also stated that a deep impression had been caused by the German avowal of an intention to sacrifice lives unjustly, and unjustly to destroy property and disorganize commerce. The Foreign Office pointed out, moreover, that Brazil could not accept the «blockade» as effective; and that the Brazilian government, in harmony with international usages, conventions and agreements, was bound to protest against such a blockade, placing on the German government the responsibility for any acts affecting Brazilian citizens, ships and merchandise. On 11 April 1917 the Brazilian government broke off diplomatic relations with Germany, as the result of the sinking of the steamship *Paraná* by a German submarine, without warning and with loss of lives, on the night of 3 April 1917 off Point Barfleur. On 1 June 1917 the Brazilian government revoked the decree of neutrality (of 25 April 1917) in the war between the United States and Germany. Next, measures were taken to make use of the German merchant vessels anchored in Brazilian ports. The plans formed at that time included the protection of Brazilian shipping abroad and co-operation with friendly nations in measures designed to secure the freedom of Brazil's foreign trade. On 4 June 1917 the Brazilian Ambassador at Washington, in his note to the Secretary of State of the United States, said: «The President of the Republic [of Brazil] has just instructed me to inform Your Excellency's Government that he has approved the law which revokes Brazil's neutrality in the war between the United States of America and the German Empire. The Republic thus recognized the fact that one of the belligerents is a constituent portion of the American continent, and that we are bound to that belligerent by traditional friendship and the same sentiment in the defense of the vital interests of America and the accepted principles of law. Brazil ever was and is now free from warlike ambitions, and while it always refrained from showing any partiality in the European conflict, it could no longer stand unconcerned when the struggle involved the United States, actuated by no interest whatever, but solely for the sake of international judicial order, and when Germany included us and the other neutral powers in the most violent acts of war.» We may add that a strong anti-German sentiment had been created in Brazil by the publication of the facts concerning the invasion of Belgium and the Teutonic atrocities during 1915 and 1916. The people and their government were of one mind when, on 25 Oct. 1917, the President of Brazil sent a message to Congress stating that it was impossible longer to avoid recognition of the state of war imposed by Germany. Accordingly on the following day, 26 Oct. 1917, the Chamber of Representatives by an almost unanimous vote (149 to 1) declared that a state of war existed between Brazil and Germany. Unanimous approval of the proclamation of war was given by the Senate also, on 26 Oct. 1917.

Costa Rica evinced the true Pan-American spirit promptly, offering the use of its ports to the warships of the United States, arresting on 16 Sept. 1917 three of the resident Germans who were charged with conspiracy, and interning all Germans who resided in Costa Rican ports. A special session of Congress was called and on 21 Sept. 1917 the government severed diplomatic relations with Germany. The diplomatic and consular representatives of Germany received their passports, and the Costa Rican legation and consuls in Germany were recalled. Costa Rica declared war on the government of the German Empire 23 May 1918.

The Dominican Republic declared its neutrality in 1916, but in June 1917 withdrew the exequatur of the German consular service and thus, in response to the general sentiment of its citizens, severed diplomatic relations with the German Empire.

Ecuador did not reach a clear and explicit decision in this matter until toward the end of 1917, but the government expressed to the Minister of the United States at Quito, in a note dated 11 Feb. 1917, the following views: «The efforts of neutral powers to soften the rigors of the present disastrous war are very commendable and worthy of applause, as are . . . the principles declared by the Government of the United States in its note of 18 April 1916, addressed to the German Foreign Office, through American Ambassador Gerard, concerning the inalienable rights of neutrals, the immunity of non-combatants, and those sacred rights of humanity which have universally and of old been accepted by civilized nations.» The President of Ecuador, in his message of 10 Aug. 1917 to the Ecuadorean Congress, advanced the thought of Pan-American solidarity in the following terms: «We continue to uphold a policy of neutrality and our efforts to secure a more open and frank understanding among all nations of the American continents. We have said on every occasion, when justice so demanded, that we are in sympathy with and have faith in the great democratic principles, the fundamental basis of those nations. America, therefore [in the wider sense, as suggested above], will always find us with it.» On 5 Oct. 1917, when Peru broke off diplomatic relations with Germany, it was stated that the German Minister at Lima intended to go to Ecuador, to which country he was accredited as well as to Peru. The Ecuadorean government announced, however, through its Minister of Foreign Affairs, on 7 Oct. 1917, that the German Minister would not be received officially in Ecuador in case he desired to present his credentials there; and two months later (7 Dec. 1917) the severance of diplomatic relations with Germany was made definite and complete.

Guatemala, in a formal statement dated 7 March 1917, protested against Germany's submarine blockade, of which it had received notification on 9 February. The whole policy adopted by the German Admiralty constituted, according to the characterization of it in that document, a violation of the rights of nations. This protest elicited no response whatever from the German government or its diplomatic representative in Guatemala, and the Guatemala government proceeded to sever diplomatic relations with Germany on 27 April 1917. It also offered its ports, territorial waters and railway facilities to the United States; and by a decree of the National Legislative Assembly, 21 April 1918, Guatemala's attitude of belligerency toward the German Empire was declared to be the same as that of the United States.

Haiti's National Assembly protested on 11 May 1917 against the establishment of the submarine blockade, asserting that Germany must be held to account in every sense for resultant injuries sustained by Haitian subjects traveling on the high seas; that a benevolent policy was adopted toward the United States, and that diplomatic relations with Germany would, if necessity for such action arise, be broken off. Accordingly when the *Karnak* and the *Montreal* were sunk, several Haitians losing their lives, the government of Haiti demanded satisfaction and indemnity. The German government emphasized its unwillingness to consider the matter by delivering his passports to the Haitian chargé-d'affaires at Berlin. The rupture was completed by the dismissal, on 16 June 1917, of the German representative at Port-au-Prince, and by a declaration of war, 12 July 1918.

Honduras, on 17 May 1917, severed diplomatic relations with Germany, as a protest against the submarine campaign. In the decree of that date we find the declarations that the republic at Honduras makes common cause with the United States, approving fully the principles that the latter's government defends; and that "it is incumbent upon Honduras to declare its attitude in the conflict between the United States and Germany on account of the submarine warfare, in violation of the principles of international law, the rights of neutral property, and commerce on the high seas." The government of Honduras offered to the United States its resolute co-operation in all possible ways and declared war on Germany, 19 July 1918.

Nicaragua, on 18 May 1917, broke off diplomatic relations with Germany. In the note of the Minister of Foreign Affairs to the resident American Minister full sympathy with the policy of the United States was expressed "by instruction of the President of the Republic," and Nicaragua was truthfully represented as being in accord with the attitude the United States had taken for the safety of all the Latin-American continent and its measure of defense of the high ideals and principles of civilization. The use of the Nicaraguan ports, territorial waters and means of communication was offered to the government of the United States. Nicaragua's declaration of war on Germany was dated 8 May 1918.

Peru sent a strong note of protest to the German government upon the sinking of a Peruvian vessel, the bark *Lorton*, 5 Feb. 1917. Later she refused to submit the case to German prize court and sent a second note, demanding a reply to the first — but without avail. On 28 July 1917 the President of Peru in his message to the Congress expressed agreement with President Wilson's war-message. "The sufferings of humanity," said President Pardo, "will not have been in vain if, through these efforts there is raised the new edifice of international society upon the immutable foundation of justice." On 7 Sept. 1917 Peru's House of Representatives, by resolution unanimously adopted, declared its adhesion to the established principles of justice and international ethics as proclaimed by President Wilson; and on the following day the Senate declared: "The international policy of Peru must be inspired by the principles of the solidarity of the nations of the American continents with the United States, in harmony with ideals of international justice proclaimed by President Wilson and with the declaration formulated . . . in the House of Representatives." The Peruvian Congress, by a vote of 105 to 6, passed a resolution severing diplomatic relations with Germany on 5 Oct. 1917, and on the same day passports were handed to Dr. Perl. (See above, *Ecuador*). On 4 June 1918 the Peruvian government took possession of eight German vessels interned at Callao. This was not, however, regarded as an act of war.

Uruguay manifested cordial approbation of the cause defended by the American government. In a note dated 14 April 1917 and addressed to the American Minister in Montevideo the Uruguayan Minister of Foreign Affairs stated that his government, while still maintaining neutrality, recognized the justice of the position taken by the United States of America. Thus, the offer of "moral sympathy and solidarity," as the Minister of Foreign Affairs expressed it, was extended without delay; and on 18 June 1917 the Uruguayan government issued its memorable decree, in which the general principle was laid down "that no American country, which in defense of its own rights should find itself in a state of war with nations of other continents, will be treated as a belligerent." On 7 Oct. 1917 Uruguay severed diplomatic relations with Germany. The rupture was announced in a presidential decree, after the Chamber of Representatives, by a vote of 74 to 23, had declared itself in favor of such action. In his message to Congress President Viera observed that although Uruguay had not received direct offense from Germany, it was necessary to espouse the cause of the defenders of justice, of democracy and of small nations; and popular acceptance of this view was emphasized at a great public meeting. Eight German ships were seized at Uruguayan ports and subsequently leased to the Emergency Fleet Corporation of the United States.

Summarizing our observations up to this point, we may say that nearly two-thirds of all Latin-American republics made known, by vigorous governmental action, their adhesion to the cause of the United States and her Allies before the end of the year 1917 and were found standing firmly for the right when the year 1918 had half run its course. We owe to John Barrett, Director-General of the Pan-American Union (see *Bibliography*), the observation (in 1917) that "the sober public sentiment of [the people of] practically all the twenty Latin American Republics is overwhelmingly pro-United States and pro-Ally in this struggle of democracy against autocracy. It would seem, in consequence, to be only a question of time when all the Latin American countries must follow the dictates and demands of this public sentiment and align themselves with the United States and the Allies." Let us now turn our attention to the remaining seven — to those whose governments maintained interesting variants of neutrality. "Argentina, Chile, Colombia, Mexico, Paraguay and Venezuela," according to a special memorandum issued in 1919, "either by the statements of their Executives or by resolutions passed by their Congresses, or again by the pro-Ally tone of their most representative statesmen also expressed themselves in favor of Pan American solidarity." As for Salvador, her declaration of benevolent neutrality toward the United States "permitted the use of her territorial waters by the war-ships of the United States and the Allies."

Argentina, on 7 Feb. 1917, made answer to

Germany's notification concerning the submarine blockade: «The Argentine Government regrets that His Imperial Majesty has thought necessary to adopt such extreme measures and declares that it will adjust its conduct, as always, to the fundamental rules and principles of international law.» In accordance with that declaration, the Argentine Foreign Office entered a strong protest when information was secured in regard to the sinking of the *Monte Protegido,* 4 April 1917; and in its note of 4 July 1917 demanded satisfaction for the sinking of the sailing vessel *Oriana* on 6 June and the steamer *Toro* on 22 June, both without loss of life. More specifically, it required indemnity, together with assurances that no more Argentine vessels would be attacked. In the *Monte Protegido* case Germany accepted the suggestion in regard to indemnity. On the other hand an effort was made to justify the sinking of the *Toro.* Argentina reiterated her demand 4 Aug. 1917. Next, into the heated controversy a new element was projected. On 8 Sept. 1917 the Department of State of the United States published several cablegrams, dated 19 May and 3 and 9 July of the same year, sent by the German chargé-d'affaires at Buenos Aires through Baron Lowen, Sweden's Minister at the same capital, to the Secretary of Foreign Affairs in Stockholm, to be delivered to the Minister for Foreign Affairs in Berlin. These dispatches contained an insolent reference to Argentina's Minister of Foreign Affairs and recommended the sinking of Argentine vessels without leaving a trace. On 12 Sept. 1917 riots occurred in Buenos Aires, in the course of which the people expressed their resentment by wrecking the German Club, the offices of the German newspaper, *La Union,* and important German business houses. The offending chargé-d'affaires, Count Luxburg, and the German legation were protected by the police. The Argentine government immediately asked Germany to disapprove Luxburg's conduct and to apologize for his discourteous language; and on 19 Sept. 1917 the Argentine Senate voted almost unanimously (23 to 1) in favor of breaking off diplomatic relations with Germany. This resolution was sent to the Chamber of Deputies for approval. On 23 Sept. 1917 the Argentine government received a note of apology from Berlin, expressing disapproval of Luxburg's utterances; but the Chamber held this to be inadequate, and on 25 Sept. 1917 by a vote of 53 to 18 upheld the Senate's course. On the next day 100,000 persons paraded through the streets of Buenos Aires; and this was but a part of a great popular demonstration in favor of war. Nevertheless the executive, it was said, did not consider it advisable to terminate diplomatic relations with Germany after the promise of discrimination in favor of Argentine ships and the apology for the Luxburg incident. This seems to have been a clear case of unrepresentative inaction: the determination of the Argentine people not finding utterance through the executive.

Chile, at the beginning of the war, declared its neutrality. Its President, on 1 June 1917, in a message to the Chilean Congress, referred to the common enemy's declared intention to establish a submarine blockade and then said: «For our part, being advised of hostile plans against neutral merchant vessels that would affect well-established maritime routes utilized as of old by countries foreign to the present armed conflict, we have found ourselves obliged to reserve the right to take measures against acts which we cannot tolerate.» But at the same time he expressed unwillingness to deviate from the line of strict neutrality. It is certainly more important to note that on 29 June 1917 the government of Chile endorsed Uruguay's declaration of 18 June that «no American country, which in defense of its own rights should find itself in a state of war with nations of other continents, will be treated as a belligerent.» In his message to Congress 1 June 1918, the President of Chile upheld the neutrality of his country.

Colombia at an early period declared its neutrality, and its government consistently maintained that original position. Nevertheless the Colombian Senate, in October 1917, passed a resolution of protest against the barbarous submarine warfare conducted by the common enemy.

Mexico's attitude was defined by President Carranza in his message to the Congress on 15 April 1917 as follows: «Having in view compliance with the high duty of preserving and defending the national interests, and inspired always by the most altruistic and humanitarian motives, I shall guide the conduct of the Government under my charge by all possible and dignified means in the direction of a most strict and rigorous neutrality.» At the beginning of a Congressional session, 1 Sept. 1917, President Carranza reviewed certain efforts that had been made by the Mexican government, the object of which was to render prosecution of the war extremely difficult. In this connection he mentioned a note in which the Mexican government had proposed that all neutrals should cease shipping supplies to the belligerents. But according to his own admission the efforts of his government to bring about a premature peace had not called forth, in other Latin-American countries, such full approval as he desired. And it is a pleasure to add that when the new Belgian Minister was presented the Mexican chief executive, in his address of welcome, himself emphasized the duty of resisting the common enemy to the uttermost, saying: «It is a great pleasure for me to express to Your Excellency on this solemn occasion, that Belgium in taking up arms as Your Excellency affirms, in defense of her neutrality, her honor and her independence, has fulfilled the most heroic act of modern times for the glory and example of weak nations. The countries which are not ready to shed the last drop of blood in defense of their autonomy and their institutions have no right to be counted in the concert of free nations, and those which do not measure dangers or curtail sacrifices to preserve them, although they may be defeated and chained, may rest assured of the advent of the bright day of their liberty, because they are worthy of it, because they live for it and were born to enjoy it.» The wholly exceptional position of Mexico was due to the circumstance that in April 1914, when American forces occupied the seaport of Vera Cruz, and for a long time afterward, the United States and Mexico were on the brink of war. It is proper to advert also to the following circumstance: The recognition of the government of Don Venustiano Carranza, on 19 Oct. 1915, was brought about in an exceptional manner, namely, through co-operative action of the American countries which, after careful investigation of Mexican conditions, granted together the official recognition to the de facto Carranza government.

Paraguay, geographically so remote from all scenes of the great war, gave evidence, nevertheless, of the feeling of her people when, on 11 July 1917, an important meeting held at Asunción was attended by the most prominent citizens, by the leaders of thought and representatives of the masses. The meeting offered ample tribute of admiration to the United States for her entrance into the conflict in defense of the principles of humanity and democracy, acclaiming her as the champion of human rights, and particularly of those of the New World. The suggestion was brought forward that Paraguay's duty was to intervene in the conflict against the common enemy, but the government has continued to profess neutrality.

Salvador's Foreign Office, in its note of 4 Dec. 1914, observed: «The use of neutrality proclamations seems to have been customary before international law clearly defined the principles which should govern the rights and obligations between belligerents and neutrals during a state of war. Later, these proclamations have been used in cases where neutrals maintain an active commerce with belligerents; have adjoining frontiers across which they might supply each other with armament; or when a neutral nation has a commercial fleet that might be affected in its traffic with belligerents. Our country in the present war is not affected by any of the above-mentioned contingencies; and as a state of neutrality and the regulations established for the same are juridic conditions emanating from the war itself and from the international principles which govern it, Salvador as a neutral is obliged to observe strictly the principles of war-neutrality. These principles must not necessarily be promulgated by this country in the form of a proclamation, as they are amply set forth in the fourteen diplomatic instruments subscribed to at the Second Conference of the Hague in 1907 and in the Declaration of London dated 26 Feb. 1909.» The Minister of Foreign Affairs also stated that notice had been given to the military commanders under his control to see to it that belligerent vessels should observe strict neutrality in the employment of their wireless apparatus. The government of El Salvador declined to take sides openly against the common enemy, but in a note dated 3 Oct. 1917 the Minister of Foreign Affairs stated that «El Salvador, as an American nation, could not fail to recognize, in the conflict between the United States and Germany the solidarity which binds it to the great Republic of the North, in view of the spirit of Pan-Americanism which should prevail.»

Venezuela, non-committal from the beginning of the war, announced its policy on 3 May 1917 through the message of the Provisional President, who stated that there had been no act of German submarines by which Venezuela had been directly affected, and, therefore, Venezuela had not been involved in the complications which had drawn the United States into war with the common enemy: «Notwithstanding this,» the chief executive added, «Venezuela reserves intact its right to defend the lives and the properties of its nationals. It follows the course of events with natural interest and identified with the principle in defense of which the United States has entered into the war; [moved also by] the traditional friendship which unites it to that nation and those general interests which are common to the Republics of this continent.» Again, in the message of 1 May 1918, the Venezuelan executive declared that his nation was in full sympathy with the principles for the defense of which the United States had gone to war.

Contributions to the Cause of the Allies were indeed extended, but with attendant difficulties, mainly economic, even in those countries of Latin America in which the natural demonstration of approval was not entirely prevented by active German propaganda. Brazil, for example, rendered valuable services — to which reference was made, in 1919, by the Brazilian Ambassador to France, who was also the leading member of the Brazilian peace delegation at Paris. In support of his assertion that Brazil had accomplished much in the Allied cause since she entered the war, the Ambassador said: «We seized 43 first-class German vessels and one German cruiser. Thirty of these vessels we turned over to France for her own use. We mobilized our entire army, of 60,000 officers and men, and all our navy. At the same time we placed our merchant fleet at the command of the Allies. We sent our best aviators to France, together with more than 100 army officers. We organized and maintained a complete hospital unit in France, with 300 beds. We kept more than 50 steamships plying between Brazilian ports and the United States and Europe, supplying our allies with coffee, cocoa, oils, nuts, cotton and sugar. We stamped out German propaganda in Brazil, put a stop to enemy espionage and interned many dangerous enemy aliens. A large part of our navy was sent to European waters, where, under command of a United States admiral, it co-operated with the Allied fleets in protecting the coasts and shipping and troop-transports from enemy submarines. Eight of our best merchant vessels were sunk by torpedoes while in the service of the Allies. Many of our seamen were lost with these vessels. Some of our seamen were picked up and interned in Germany. We feel our position is quite modest, but hope for the complete approval by the conference of what we did.» (Consult *New York Herald*, 3 Feb. 1919).

Large sums of money were raised in Latin America for the loans of all the Allies (consult 'Selling War Bonds in South America,' in *The South American*, New York, October 1918, p. 5).

Special mention should be made here of Cuba's highly creditable part in the war. When speaking in a general way about the participation of Cuba, the Secretary of War of that republic mentioned a few interesting details in July 1918, saying, among other things: «We have established training camps in Cuba, both military and naval, and through the courtesy of the United States we have placed officers at Key West and Pensacola for instruction.

France has detailed two Cuban aviators, who have achieved brilliant records in France with the Lafayette Escadrille, to act as instructors in our aviation school. We have purchased additional equipment and materials necessary to make this arm of our service effective. . . . If our forces are needed on the western front, they will go there. It should be distinctly understood that the Cuban government will withhold nothing that it possesses that can be used to advantage by our allies in the fight against Prussian militarism.' On 19 Oct. 1918 announcement was made in Havana that Cuba's total subscriptions to the Fourth Liberty Loan amounted to $10,000,000, or $4,000,000 more than the quota allotted to her. The President of Cuba, in an authorized statement, has said: 'A relatively considerable number of large German steamships were held by the war in Cuban ports. I ordered their immediate seizure, as the governments of all the belligerent nations have done in similar cases, and turned them over to the United States to be used freely in the prosecution of the war. To the same end of frank co-operation, the government of Cuba authorized the sending of American troops to different points in Cuba for military instructions and preparations. For the same purpose a goodly number of officers and enlisted men of the Cuban army were sent to the United States to complete and perfect their training for war. The law establishing obligatory military service empowers the President to take steps for sending a contingent of our present regular army to the European battlefields, reinforced by volunteers who wish to go and who have already, indeed, begun to enlist in considerable numbers. The President is also authorized to send military missions to the United States, England, France and Italy. The 4th of July, anniversary of the independence of the United States, and the 14th and 21st of July, celebrated in France and in Belgium as patriotic fêtes, have been declared legal holidays.' (see article CUBA).

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MARRION WILCOX.

6. TRANSPORTATION AND COMMUNICATION IN LATIN AMERICA.

Railways.—Although several countries lay claim to having the oldest railway in South America it appears that the first road to be actually opened for service was a line five miles long, finished in British Guiana in 1848. In the next year a line was completed between Caldera and Copiapó, Chile, and in 1857 the first road began operations in Argentina, Brazil following a year later. Since that time construction has been practically continuous, and now every country in South America has its railway system. Naturally expansion of railway transportation has been most rapid in the level plains of Argentina, where rails have been laid at comparatively little expense, and it has made least progress in the west and north, where mountain construction often runs the cost up to more than $100,000 a mile. The railway mileage of South American countries (not including minor private and other lines) was (1917) as follows:

COUNTRY	Mileage
Argentina	21,325
Bolivia	850
Brazil	16,146
Chile	5,015
Colombia	698
Ecuador	427
Guiana:	
British	100
Dutch	109
French	......
Paraguay	231
Peru	1,900
Uruguay	1,639
Venezuela	530

In each country this mileage serves national needs almost entirely, and tourists will find that communication between countries is still largely by coast or ocean vessels.

Travel to South America as a rule follows a well-beaten path. The tourist who wishes to visit the chief centres usually travels on one of two routes — down the east coast to Buenos Aires, across the continent to Valparaiso, up the west coast to Panama, and thence to Colombia and Venezuela, or the reverse of this journey, making the north-coast countries from Barbados or Trinidad. If he elects the former route his first stop will probably be at Pernambuco, where most ocean liners serving Brazil call. Coast steamers will carry him to Pará, Natal and points between, but the tourist whose time is limited can continue by ocean steamer to Bahía and to Rio de Janeiro. From Rio a favorite trip is that by rail to São Paulo, thence by rail to Santos, where the steamer can again be caught for Rio Grande do Sul, Montevideo and Buenos Aires. From Buenos Aires various side trips can conveniently be made, including a visit to Asunción, capital of Paraguay. The only transcontinental line in South America affords rail accommodations between Buenos Aires and Valparaiso, Chile, where the traveler usually takes a boat for the trip along the west coast. If he wishes to visit Bolivia he stops at Antofagasta, reaching La Paz from that port by rail in about 45 hours. *Siroche* or 'mountain sickness,' however, caused by a too rapid change from the coast to an altitude of over 12,000 feet, may make a more gradual ascent advisable. From La Paz two other railways reach the coast, that leading to Mollendo, Peru, having heretofore had the most passenger traffic. At Mollendo the sea voyage is continued to Callao-Lima, thence to the northern ports of Peru and to Guayaquil, Ecuador, from which the capital, Quito, can be reached in a two-days' journey. Steamships carry the traveler from Guayaquil to Panama and through the canal to Colón, where connection can be made for Cartagena, Colombia. After possible trips to the interior cities of Bogotá and Medellín, connections are made at Cartagena or Puerto Colombia for Venezuelan ports, the most important of which are Puerto Cabello and La Guaira, from both of which the capital, Caracas, can be reached by rail. As convenient the traveler can then either go to Trinidad or Barbados and catch a north-bound boat, or return to Colón.

It will be seen that on a South American tour of this kind a great part of the travel is by boat, and railways are as a rule of only local convenience. If he desired to do so, however, the traveler could land at Victoria, Brazil, and continue on the route mentioned entirely by rail to Mollendo, Peru.

Most of the railways of South America have been built by European capital, largely English. The equipment is therefore for the most part European. Government ownership and operation are most prominent in Chile, but exist also in Brazil, Argentina and other countries. There are a multitude of gauges, ranging from the broad 5 feet 6 inches of various Argentine lines to 2 feet 6 inches of the Antofagasta (Chile) and Bolivia line in Chile, and even narrower private lines. Accommodations for passengers on many roads, notably those of the larger Argentine and Brazilian systems, are the equal of those in the United States, luxurious parlor-car, sleeping-car and dining-car service being provided. Fares are variable but for the most part are not excessive. Rates for excess baggage, however, are usually high.

Before reviewing briefly the transportation systems of the various countries, the much-discussed project of the Pan-American Railway should be mentioned. This project is the proposed linking-up of existing lines to afford railway service through North and South America, from New York all the way to Buenos Aires. Existing lines could be utilized to the southern border of the United States, and the National Railways of Mexico line would carry the train to the Guatemalan border. Railways now in operation, being built or projected would afford passage through Central America to Panama, where construction to the Colombian border would involve the conquering of the tropical forest. At the other end of the line there is through trackage from Buenos Aires to Cuzco, Peru, except for a stretch of about 66 miles, now under construction between La Quiaca and Tupiza, Bolivia, and there are various mountain lines in Colombia, Ecuador and Peru which would form links in the completed chain. Much of the construction yet to be affected, however, is in difficult country and it will be many years before the great dream is a reality.

SOUTH AMERICA.

ARGENTINA.— The great level plains of Argentina, with their wealth of agricultural and pastoral products, have made the river Plata region the centre of railway expansion in South America. From Buenos Aires a great network of lines stretches out to the north, west and south, connecting practically every important town or city of Argentina with the capital and bringing the country to a rank of ninth in point of railway mileage among the nations of the world. The following distances by rail from Buenos Aires to other cities of Argentina will illustrate the extent of railway development: To Bahía Blanca, 446 miles; Tucumán, 720 miles; Mendoza, 647 miles; San Juan, 745 miles; Santa Fé, 299 miles; Rosario, 186 miles; Córdoba, 433 miles; Salta, 996 miles; Santiago, 628 miles; Jujuy, 1,006 miles; San Luis, 485 miles; Catamarca, 771 miles; Mar del Plata, 248 miles. Up to the outbreak of the European War the mileage was being steadily extended, but that event practically suspended construction through the curtailment of the supplies of foreign capital necessary for extensive building.

The systems of Argentine railways, with their mileage (excluding private and other minor lines) are as follows: Buenos Aires and Pacific, 3,535 miles; Buenos Aires Great Southern, 3,792 miles; Buenos Aires Western, 1,870 miles; Central Argentine, 3,305 miles; Córdoba Central, 1,205 miles; Entre Rios, 831 miles; Buenos Aires Midland, 322 miles; Argentine North Eastern, 752 miles; Province Santa Fé, 1,192 miles; Rosario-Puerto Belgrano, 493 miles; General Buenos Aires, 790 miles; Central Northern, 1,790 miles; Argentine del Norte, 1,196 miles; Buenos Aires Central, 252 miles. Most of these systems are owned wholly or in part by English shareholders (English capital having been invested in Argentine railways to the extent of almost a billion dollars), and the securities of the more important roads are quoted regularly on the London Stock Exchange. Of the total mileage the government owns some 4,000 miles, the longest roads being the Central Northern Railway, running from Santa Fé northwest to the Argentine boundary at La Quiaca, and the Argentine Northern, running from Santa Fé west to San Juan, both roads having several branches. The government is interested in building and operating railroads chiefly in order to open up new territory, and the roads in many cases are run at a loss.

Argentine railways have three different gauges. The broad gauge of 5 feet 6 inches, said to have been introduced when the first railway builders purchased rolling stock of this gauge which had been used in the Crimean War, prevails on several of the larger roads, including the Buenos Aires and Pacific, the Buenos Aires and Great Southern, the Buenos Aires Western and the Central Argentine. The middle gauge, 4 feet 8½ inches, is used by the Entre Rios Railway, the Argentine North Eastern and the Buenos Aires Central. The government lines mentioned, the Transandine Railway, the Córdoba Central, the Buenos Aires Midland and the Province of Santa Fé are of metre (3.28 feet) gauge. Freight carried on these roads naturally consist very largely of grain, livestock and animal products such as wool and hides, but considerable quantities of wine and grapes are carried from the vineyards of Mendoza and other western provinces.

The passenger service of these lines is quite up-to-date, and all the comforts appertaining to modern railway travel are provided. The line of the Central Argentine between Buenos Aires and Rosario has been double-tracked, and the running time between these cities, a distance of 186 miles, has been reduced to four and a half hours. The fare is not excessive. One of the minor drawbacks to railway travel in many parts of Argentina is the monotony of landscape, some lines running for hundreds of miles over level plains with practically no trees or hills to be seen in any direction. The railway system in general is such that every city of consequence in Argentina can be conveniently reached from Buenos Aires, and tourists and commercial travelers find it a good plan to make the capital their headquarters, taking side trips to other centres as may be desirable. The fact that a great part of the import and export business of the country flows through Buenos Aires makes it unnecessary for foreign salesmen to visit many of the outlying cities. Tourists, however, will find it interesting to visit Tucuman, where Argentine independence was declared; Mendoza, the centre of the wine industry; Rosario, second to Buenos Aires as a shipping centre; La Plata, where there are a large observatory and large meat-packing plants; and Mar del Plata, the great seaside resort.

Uruguay.— The fact that Uruguay, smallest of South American republics, has some 1,600 miles of railway is an illustration of the progressiveness of the country, as well as the facility in construction afforded by the level or gently rolling character of the land. The chief system is the Central Uruguay Railway, which operates approximately 1,000 miles of track. Its main line and an extension connect Montevideo with the Brazilian frontier and join the Rio Grande system at Sant' Anna. Nearly all lines are controlled by British capital, and as a rule return a good profit. They are for the most part operated under a government guarantee.

In the third of the river Plata countries, Paraguay, there is as yet but a single line, the Paraguay Central, running from Asunción, the capital, to Villa Encarnación, where it makes connection with the Argentine North Eastern. A branch from Villa Rica to the Brazilian frontier is being constructed, to connect with the São Paulo-Rio Grande Railway and give through connection with the Atlantic Coast. At present Asunción is reached in about 50 hours from Buenos Aires over the road mentioned, or by river boat, the trip upstream taking five days and the return trip four days. An extension of the Santa Fé Railway of Argentina is being constructed which has for its objective a point in Argentina opposite Asunción, the complete line to be entirely in Argentine territory but giving Asunción another outlet to the sea.

Chile.— From Buenos Aires the broad-gauge tracks of the Buenos Aires and Pacific lead away 647 miles to Mendoza, joining there with the meter-gauge Argentine Transandine Railway. This continues 111 miles to the Transandine Tunnel, two miles long. The Chile-Argentine boundary line is reached about halfway through the tunnel, and across the line the journey is over the track of the Chilean Transandine Railway to Los Andes, 47 miles. From there to Valparaiso (83 miles) runs the line of the Chilean National Railway. The whole distance from Buenos Aires to Valparaiso is 888 miles. This Transandine route has made unnecessary the long voyage around the Horn when traveling between Valparaiso and Buenos Aires, the railway trip now being made in two days. The line does not carry a great amount of freight but has a good passenger traffic. During the winter months it is often blocked by snows and the service is consequently very uncertain from June to August.

The character of the railway development of the west coast has been determined by the peculiar contour of the land. Along practically the whole length of the South American continent the high ridges of the Andes lie only a comparatively short distance back from the coast. For the most part, therefore, the railways of Chile, Peru and Ecuador consist of short lines crossing the narrow strip of coast lands between sea and mountains, here and there climbing over the high passes into the interior plateau.

The chief exception to this is the Longitudinal Railway of Chile, running from Puerto Montt in the south to a point near Iquique (eventually to be extended to Arica). Because of the proximity of the mountains to the sea and their height, railway construction has been exceedingly costly and difficult and has required the solution of more engineering problems than construction in any other part of the world. The highest railway in the world is to be found in Peru, a branch of the Central of Peru Railway reaching to the height of 15,865 feet, while farther south, in Bolivia, a branch of the Antofagasta (Chile) and Bolivia Railway running to Potosi attains 15,814 feet. So far the rail connection between Buenos Aires and Valparaiso is the only one affording transcontinental service, but, as mentioned above, the completion of 66 miles of track between La Quiaca and Tupiza will open another through route. Work on this connection has been carried on intermittently for several years. A third route will be opened when Bolivia's railway system is extended to meet the track of the North Western of Brazil Railway, practically completed to the border town of Corumbá. Another transcontinental line, to run from Bahia Blanca, Argentina, to Talcahuana, Chile, has been discussed, but no active work is being done on it. There is already a road from Bahia Blanca to Neuquén, in Argentina.

Of the 5,000 miles of railway open in Chile about 3,000 miles are owned by the government, Chile being the only country in South America that has an extensive government-owned system. These roads are for the most part operated at a loss. The private lines are mostly "nitrate" railways, owned and operated by the companies exploiting the nitrate fields in North Chile.

Bolivia.— The country of Bolivia, entirely cut off from the sea, has three rail connections with the coast, two of these being through Chile and one through Peru. The lines through Chile run from Antofagasta and Arica to La Paz, and that through Peru to Mollendo. The southernmost line is that of Antofagasta (Chile) and Bolivia Railway, from Antofagasta to Oruro, Bolivia, a distance of 575 miles. From Oruro the Bolivia Railway, leased by the Antofagasta Railway, leads to Viacha, 125 miles, and the rest of the distance to La Paz, 19 miles, is covered by a line constructed by the Antofagasta Railway, as well as by two others. The whole distance of about 720 miles is covered in 45 hours. The second line to the coast is the Arica-La Paz line of 248 miles, of which 28 miles is rack road. The time required for the trip to La Paz from the coast is about 25 hours and for the journey in the other direction 15 hours, the first-class fare being about 6½ cents a mile. The third line to the sea is through Peru to Mollendo, the total distance being 534 miles and the running time about 29 hours to the coast, part of the journey being made by steamer on Lake Titicaca. This road is the Southern Railway of Peru, which also operates a branch from Juliaca to the ancient Inca capital, Cuzco, 210 miles, a favorite objective of tourists. While most of the traffic to and from Bolivia has been by way of the first and third of these routes, the second is considerably the shortest and there is, moreover, one of the best harbors along the Pacific Coast at Arica. The line was opened in 1912 and is expected to build up a volume of business between La Paz and the coast that will equal that of its older competitors.

Peru.— Besides the Southern Railway, Peru has one other line that climbs the Andes from the coast. This is the famous Central Railway of Peru, one of the most wonderful railways in the world because of the number and character of the engineering difficulties overcome. It was surveyed and partially completed by Henry Meiggs, an American engineer, at an enormous cost. It runs from the port of Callao to Oroya, 138 miles, with an extension to Huancayo, a further 70 miles to the south. The main line passes through 57 tunnels and reaches a height of 15,665 feet, a branch to Morococha going 200 feet higher. This branch, as noted above, is the highest railway in the world. At Oroya the Cerro de Pasco Railway leads to the town of that name, the site of an important American copper mining enterprise. Besides these railways there are various shorter lines, chiefly connecting the agricultural valleys of the coastal regions with Pacific ports.

A large part of the mileage of Peruvian railways is controlled by the Peruvian Corporation, a company formed in 1890 by European holders of Peruvian securities, the payment of interest on which was in default. The agreement between the government and the corporation is such that the latter dominates the railway situation in Peru. The company is interested in new construction, and has surveyed for the government a line to run from Tiripata, on the Southern Railway, to the Madre de Dios River, which will open up a through rail-and-water route to the Atlantic. Other trans-Andean lines are projected in the northern and central sections of Peru.

Ecuador.— The only railway of importance in Ecuador is the Guayaquil and Quito line, built, owned and operated by Americans. This line is another example of daring mountain construction. It has a total length of 287 miles and the journey to Quito takes two days. There are also railways inland from the ports of Bahía de Caracas, Manta and Bolívar, and lines are projected from Quito to the coast and from Ambato, on the Guayaquil and Quito Railway, to Curaray in the interior, which will open up the rich tropical sections of the Amazon Valley in Ecuador. Work on the latter line is proceeding slowly.

Colombia.— In the north-coast countries of Colombia and Venezuela railroad building has made little progress, partly because of the mountainous character of the country and partly because of the fact that each country is but sparsely inhabited. In Colombia the main arteries of travel are still the rivers, particularly the Magdalena, and nearly all railways lead off from this river or from the seacoasts. The foreign traveler usually lands either at Cartagena (thence reaching the river by rail at Calamar, 62 miles away), or at Puerto Colombia, going thence to Barranquilla, a rail distance of 17 miles. A river boat carries him to La Dorado, where the Dorado Extension Railway leads around a series of rapids to Puerto Beltran, the river voyage being then continued to Girardot. The rest of the journey to Bogotá, the capital, is by railways of two different gauges, a distance of 109 miles. From Bogotá two short lines lead out north and southeast, besides the line running to the Magdalena River. The Antioquia Railway, nearly completed, connects Medellín with the Magdalena, and a short line leads out from the river port of Puerto Wilches, to be eventually continued to Bucaramanga. Isolated lines serving local needs include the Cucuta Railway (44 miles) in the east, the Santa Marta Railway (92 miles) in the north, and the Cauca Railway (103 miles) in the west. A short line running from the Magdalena at Girardot to Espinal completes the list. The railway construction program of Colombia includes the completion of the lines from the Magdalena to Bucaramanga and to Medellín, the continuation of the Cauca Railway to Popayan, the connecting of the Cucuta Railway with the Magdalena, the building of a line from Medellín to the Gulf of Darien, and the construction of a line from Girardot to Cali, thus giving Bogotá access to the Pacific.

Venezuela.— The 530 miles of railway in Venezuela are all of three and one-half feet gauge or less, and serve the regions along the coast. The chief line is the Great Railway of Venezuela, a German road of 111 miles running from Caracas to Valencia. It was a costly road to build, having 86 tunnels and 212 bridges. Both the terminal cities of this road are connected with the coast, Valencia by an English-owned railway of 34 miles running to Puerto Cabella and Caracas by the La Guaira and Caracas line, also English, which in its 23 miles passes over 10 bridges and through nine tunnels, and climbs 5,000 feet. The Bolivar Railway (109 miles) connects the interior city of Barquisimeto with the coast at Tucacas, and is important as a carrier of copper ore from the mines at Aroa, about 50 miles from Tucacas. This road is also English-owned as is the Central Railway (46 miles) running southeast from Caracas. Most of the other railways, penetrating short distances into the interior from the coast and from lake Maracaibo, are financed by Venezuelan capital, three being government-owned. Several projects for new railways have been talked of, but extensive construction will have to await the development of the country.

GUIANA.— In British Guiana there are about 100 miles of railway, the chief line being that from Georgetown to New Amsterdam, 60 miles long. Dutch Guiana has a single road of about 109 miles.

BRAZIL.— Brazil, a country whose great expanses have as yet not even been fully explored, holds great promise for future railway construction. There are now some 16,000 miles of railroad in the country, and lines projected and under construction when the European War broke out would have added 8,000 or 10,000 miles more. Existing lines, with one notable exception, have naturally been laid where the country is most thickly settled, that is, in the coastal regions and the immediate hinterland, and the great interior plains and forests are penetrated by only one line that has connections with the coast. Construction has been most in evidence in the more productive section, comprising the agricultural and mining states of the south. Almost one-half of the total mileage of the country is owned by the federal government, although most of this is leased. The gauges of Brazilian railways range from two feet to five feet three inches, but about 90 per cent of the mileage is metre gauge.

The chief economic value of these railways heretofore has been to bring the products of each general section to the coast, and communication between northern, southern and western states is still largely by ocean or river steamer. The traveler visiting the several coast cities has little use for the railways until he reaches Rio de Janeiro. From Rio the usual journey (requiring all of one day), is by rail to São Paulo, one of the most thriving commercial cities of South America, and then to the coast again at Santos, where steamer connection is made for southern Brazil and the river Plata. However, the traveler, if he wishes to do so, can reach both Uruguay and Argentina by rail from Rio de Janeiro. Sleeping and dining-car service is provided, but the rates are high.

The line that connects the capital with many of the important cities of southern Brazil and the oldest line in the country is the Central of Brazil Railway, whose broad and metre gauge tracks lead to São Paulo in the southwest and to Bello Morizonte and other important centres in the north. It is government-owned, and returns a large annual deficit. The country's best-paying line is the São Paulo Railway, running from Santos to Jundiahy via São Paulo, which carries a tremendous freight of coffee annually. There are two tracks over the 50 miles between São Paulo and Santos, and grades of 8 per cent are surmounted by means of endless-cable systems. Other important lines of this region that should be mentioned are the Mogyana, Sorocabana, Paulista, South Minas, West of Mines and Brazil Railway systems. The last named is the comprehensive system controlled by a company known as the Farquhar Syndicate, incorporated in Maine, which carried forward ambitious development plans that involved railway construction or control in Brazil, Uruguay, Paraguay and Argentina. This development, however, was largely suspended by financial difficulties on the outbreak of the European War, and the company passed into the hands of a receiver. The southernmost states of Brazil are served by this line and by the Great Southern, the region to the north of Rio de Janeiro by the Leopoldina Railway, the region around Pernambuco by the Great Western, the state of Ceará by the Brazil North Eastern, and Bahía by the state of Bahía Southwestern. There is at present no through rail connection between north and south, but it is planned to have the Central of Brazil extended eventually to Pará, thus affording railway communication for all the states on the Atlantic seaboard. Construction is also reaching out toward the western plains, and a transcontinental line through Bolivia will eventually be built.

Far removed from all other lines is the Madeira-Mamore Railway, 1,800 miles into the interior, which spans a series of rapids in the Madeira, Mamore and Beni rivers. These rapids are the only obstruction to river traffic from the interior of Bolivia to the Atlantic, and the road of 225 miles was constructed (with great difficulty and only after repeated failures) to afford an outlet for the products of eastern Bolivia.

MEXICO AND CENTRAL AMERICA.

MEXICO.— Before the revolution broke out in 1910 Mexico had witnessed a steady expansion of its railways, which formed a network that afforded an outlet for the products of almost all parts of this potentially wealthy country. In the years that followed the overthrow of Diaz not only has new construction been materially diminished (though not entirely suspended) but millions of dollars' worth of track and rolling stock have been destroyed. In normal times the country is well served by its railways. It has about 16,000 miles of railway, mostly standard gauge (four feet eight and one-half inches) of which about 7,300 miles are owned or controlled (but not operated) by one system, the National Railways of Mexico. The government organized this system by combining the National Railroad of Mexico and the Mexican Central, in 1908, and later adding the Mexican International, the Vera Cruz and Isthmus and the Pan-American. The government owns 50.3 per cent of the ordinary stock and thus has full control. The principal line of the system runs from Nuevo Laredo, on the northern border, through the states of Nuevo Leon and San Luis Potosí on down to Mexico City, with several branches east and west.

Other important lines of Mexico include the Southern Pacific of Mexico, running from the northern border through the western states of Sonora and Sinaloa to Tepic, whence it will be continued to join the National Railways of Mexico at Guadalajara; the Mexico North Western Railway, one of the two lines joining El Paso and Chihuahua; the Mexican Railway, running from Vera Cruz to Mexico City, with several branches; the Kansas City, Mexico and Orient Railway, which when completed will join Kansas City with the port of Topolobampo on the Gulf of California; and the Tehuantepec National Railway, running from coast to coast between Salina Cruz and Puerto Mexico. The only isolated system is the United Railroads of Yucatán, and a line is projected which will join this with the other railways of the country.

Mexico has a carefully worked out body of railway law, and the Minister of Communications is assisted by a standing advisory Railway Commission of nine members.

Central America.— In Central America through connections from ocean to ocean are afforded in three countries, Panama, Costa Rica and Guatemala (considering Panama a part of Central America). On these and other Central American lines the traveler will find some of the finest scenery attending railway travel anywhere in North and South America. Both freight and passenger rates are high, but the service in general is good. The oldest and best-known line, the Panama Railway, has been carrying immense amounts of traffic across the isthmus since it was opened in 1855, and its earnings have been very large. It is 47 miles long, and the trip between the Atlantic and Pacific terminals is made in about one and one-quarter hours. From Port Limón, in Costa Rica, the three and one-half foot gauge Costa Rica Railway (leased by the Northern Railway of Costa Rica) carries the tourist through wild and beautiful country to the capital, San José, in some five or six hours, a daily service being maintained in both directions. The fare is $3.90 gold. Over another line the traveler may also reach the Pacific Coast at Puntarenas, 69 miles from San José, in about the same time. The freight traffic of these Costa Rican railways is very largely made up of bananas and coffee shipped by the United Fruit Company. A system that promises much for the future development of Central America is that of the International Railways of Central America. This now includes the lines joined to make the ocean-to-ocean route from Puerto Barrios, on the Atlantic, to San José on the Pacific, together with a branch at Santa Maria and a line running westward from La Union, Salvador. When projected roads are completed the International Railways will have continuous track from the Mexican border to Panama, which will complete the North American part of the Pan-American Railway.

The railway mileage of the countries of Central America is as follows: Panama, 202 miles; Costa Rica, 450 miles; Nicaragua, 200 miles; Salvador, 184 miles; Honduras, 300 miles; Guatemala, 500 miles.*

Ocean Transportation.— The fact that a large part of the foreign trade of South America has been with Europe has caused a great development of ocean transportation service between the two continents. Until a few years before the World War the only regular communication of any importance between South America and the outside world was over the lines of ships that ran to European ports. It was customary for passengers bound for South America from the United States to go by way of Liverpool or Hamburg, and a great deal of freight was also routed via these ports. While this has decidedly changed and the United States enjoys reasonably good freight service with South America, it is nevertheless true that in normal times transportation facilities to and from Europe are immensely better than to and from the United States. This is due in large part to the nature of the resources and commerce of Europe, South America and the United States. South America is distinctly a continent of raw materials, while Europe is a producer of manufactured articles and has been, moreover, an investor of immense amounts of capital. A heavy volume of oversea traffic and a consequent growth of shipping was, therefore, very logical. The United States, on the other hand, has until recent years supplied itself with most of its foodstuffs and other raw materials and has also not actively sought foreign markets for its factory products. Direct transportation facilities to South America, therefore, have been in demand only in a comparatively few years and the freight and passenger traffic, even after direct service was well established, has been carried almost wholly in foreign bottoms. Before the beginning of the European War a triangular trade route had been evolved by which vessels carried manufactured goods from Europe to South America, coffee, hides and a few other staples from South America to the United States and various American exports to Europe. The radical changes resulting from the war, together with the steadily increasing interest of the United States in South American trade, will undoubtedly cause the establishment of more ample direct facilities between North and South America, which in time will rival the facilities heretofore enjoyed by European countries.

After the outbreak of the World War in 1914 shipping service to South America was of course anything but normal. The price of charters advanced as much as 1,000 per cent, and ships were often not to be had at any price that would justify the dispatch of cargo. Any description of shipping conditions during the war would give little indication of the ordinary state of ocean transportation. The following account will, therefore, be confined to a review of the service offered immediately before the beginning of the war, although most of the lines mentioned have maintained a more or less interrupted service during its continuance.

European shipping, carrying mostly foodstuffs, hides and skins, and similar commodities to Europe, has been much more in evidence in the ports of Brazil and the river Plata than on the west and north coasts and scores of vessels, some of them registering as high as 20,000 tons, have come and gone at all seasons of the year. The port of Buenos Aires saw its business grow so rapidly that elaborate construction of docks was hardly sufficient by the time it was completed to take care of the growing traffic. In 1913 a total of 700 passenger-carrying vessels entered the port from overseas, bringing 316,000 passengers. Many of the large liners that reached Buenos Aires put in also at Rio de Janeiro and Montevideo, and these also were busy ports. Liners flying the flags of European countries, together with the ships of one Brazilian line, afforded most of the regular communication between the east coast and New York, and the American flag, carried only by an occasional sailing vessel or tank steamer or the monthly vessels of one American line to Brazil, was counted a rarity along the east coast.

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* These figures, which are approximate only, are taken from 'Railway Expansion in Latin America' by Frederic M. Halsey.

England has enjoyed the bulk of South American trade and English lines have been more numerous than any other. The Royal Mail Steam Packet Company was perhaps the most prominent of these. It maintained a weekly service, its modern steamers of 15,000 tons and more making the voyage from Liverpool to Buenos Aires in 18 days regularly, and on occasion covering the distance from Cadiz, Spain, to Rio de Janeiro in 11 days. The Lamport and Holt Line had passenger and freight steamers running to the river Plata both from New York and from English ports, and steamers of the Booth Line plied regularly between England and North Brazil and Amazon ports, and between New York and these ports. Other lines offering service between the east coast of South America and England were the Harrison Line, the Houston Line, the London and Northern Steamship Company, Ltd., the Blue Star Line, the British and Argentine Steam Navigation Company, Ltd., the Nautilus Steam Shipping Company, Ltd., the Nelson Line, the Prince Line and a line operated by the New Zealand Shipping Company, Ltd., and Shaw, Savill and Albim Company, Ltd. All these sent their ships to the river Plata, and the Royal Mail, in addition, had regular boats to Venezuela and to Panama, offering service, through transshipment, to the west coast. Direct service to the west coast was maintained by the Pacific Steam Navigation Company, a subsidiary of the Royal Mail. The fastest of the river Plata steamers made Lisbon in about 14 days and Southampton in 17 days from Buenos Aires, and the first-class fare ranged from $110 to $160.

Next to the English the ships of the Italian lines were most numerous in traffic to the east coast. This was due to the large movement of Italian immigrants into Argentina and Brazil, many of them going over for the harvests and returning to Italy to spend the rest of the year at home. Those who settled permanently brought their tastes with them and the demand for Italian articles built up a trade of considerable proportions. The following lines maintained a service consisting mostly of monthly sailings each way between Italian ports, usually Genoa and Naples, and the river Plata: Italia Line, La Veloce, Italian Lloyd, Lloyd del Pacifico, Lloyd Sabaudo, Navigazione Generale Italiana, Ligure Braziliana and Sicula-Americana. The German flag was carried by the large vessels of the Hamburg-South American and the North German Lloyd to Brazilian and Argentine ports, and by the Roland Line to west coast ports. The first-named line maintained a weekly service to European ports, including Lisbon, Vigo, Southampton, Boulogne and Hamburg, calling at Rio de Janeiro on the way and covering the distance between the river Plata and Lisbon in about 16 days. The first-class passenger fare to Europe was about $160. Regular liners were also to be seen in the river Plata in weekly, fortnightly or monthly service from France, Denmark, Holland, Spain, Belgium and Sweden, and even the interior countries of Russia and Austria-Hungary found it desirable to maintain a regular service through their own national lines. Besides the regular boats there were a large number of tramp steamers and sailers and specially chartered boats plying between Europe and the river Plata, for the most part carrying grain and livestock products from Buenos Aires, Rosario, San Lorenzo (near Rosario) and Bahía Blanca, and bringing back coal and miscellaneous cargo.

Between the United States and the river Plata six steamship lines, all British, offered freight service and one or two of these also carried passengers. These were the Lamport and Holt (the only important passenger-carrying line), Barber, Norton, Houston, Prince and American-Rio Plata lines. They maintained a fortnightly or monthly service from New York, stopping at Brazilian ports in one or both directions. The United States and Brazil Line, flying the American flag, was established primarily to carry the products of the United States Steel Products Company to Brazil and bring back manganese for steel manufacture, but it also offered general cargo service. The Booth Line had sailings from New York to Para, Manaos and Iquitos, and also on occasion to ports on the north coast of Brazil, and the Brazilian line, the Lloyd Brazileiro, operated between New York and all the important Brazilian ports.

The west coast enjoyed adequate ocean transportation facilities, both to oversea countries and between the various coast ports. The regular European lines included the Kosmos and Roland lines, flying the German flag, the three English companies, the Pacific Steam Navigation Company, Gulf Line and Lamport and Holt, and the Johnson Line, maintaining service to Denmark and Norway. To the United States ships of three lines sailed regularly from west coast ports—the Merchants, West Coast and New York and South America lines, each with sailings varying from one to two months apart. These lines made the trip around the Horn until the opening of the canal, but now go by way of Panama. Between Japan and the Pacific Coast the large ships of one line, the Toyo Kisen Kaisha, provided regular and adequate service. In the coasting trade between the ports of Chile, Peru and Ecuador three companies maintained regular schedules, the Pacific Steam Navigation Company, the Compania Sud Americana de Vapores (Chilean) and the Compania Peruana de Vapores y Dique del Callao (Peruvian Steamship and Drydock Company of Callao). Ships of the Kosmos Line and others sailing to transoceanic ports also made stops at the important ports of the west coast and carried more or less coasting traffic. Besides these regular sailings there were a large number of tramp steamers and sailing vessels taking nitrate from Chile to Europe and the United States or bringing coal from Australia and Wales.

The flags of more than half-a-dozen countries were carried on the ships of the regular lines that served the ports of the north coast. Spain was represented by the Compagnia Transatlantica de Barcelona, Italy by La Veloce, France by the Compagnie Générale Transatlantique, Holland by the Royal Dutch West India Mail, Germany by the Hamburg American, England by the Harrison and Leyland lines, the Royal Mail Steam Packet Company and the United Fruit Company (British vessels sailing from United States ports), and the United States by the "Red D" Line. The ships of most of these lines touched at ports of both Venezuela and Colombia, usually, however, going in one direction, New Orleans or New York being visited either before or after the Caribbean ports on the round trip from Europe. The United Fruit Company had sailings only to Colombia, and the Red D Line and the Royal Dutch West India Mail visited only Venezuela.

In Venezuela, La Guaira and Puerto Cabello were the chief ports of call, the cargo to and from Maracaibo, the important coffee district, being transshipped at Curacao, and a good part of the trade of Ciudad Bolivar and the Orinoco being handled through Trinidad. In Colombia either Cartagena or Puerto Colombia, the port for Barranquilla, was visited by the liners serving the country, and in addition the port of Santa Marta became prominent because of heavy shipments of bananas. Barranquilla, the most important commercial city of the Colombian Republic, is shut off from the ocean by a great bar at the mouth of the Magdalena, which permits the entry of boats of lighter draft only. Various projects have been discussed and contracts have even been let for dredging and maintaining a channel through this bar, but this has not been accomplished so far and cargo must come and go through Puerto Colombia.

The various lines carrying the commerce of the United States with South America may be said to have furnished a fairly adequate service, and in the main their ships were ready to carry all the cargo that offered. There has been considerable agitation in recent years for the establishment of American steamship lines to carry freight and passenger traffic between the United States and Latin America, but this has arisen from a desire for many advantages derived from a national service rather than from a conspicuous inadequacy of cargo space. Nevertheless there is little question that American-owned vessels would do much to assist in the upbuilding of United States trade with Latin America. American lines could expand their service with the increasing demands from American shippers, and could adopt policies that would directly encourage a steady trade increase. A faster schedule with more frequent sailings of passenger vessels to Brazil and the river Plata would help to bring shipping communications from New York to a par with those from Liverpool, Hamburg and Genoa. A constant community of interest between American industries and the companies which transported their products to Latin America would work for as great an expansion of both trade and shipping as could reasonably be expected under normal conditions of competition. It is probable that with the growth of interest in foreign trade in the United States the establishment of American-owned lines to all parts of Latin America will be a question of only a short time.

The time now required for the voyage from New York to Buenos Aires is 24 or 25 days, to Rio de Janeiro 17 days, to Colón 7 days, to Cartagena 8 or 9 days, to La Guaira 8 to 10 days, to Guayaquil, Ecuador, 12 to 14 days, to Callao, Peru, about 15 days and to Valparaiso, Chile, about 22 days. The West Coast and the Merchants lines offer through service to the west coast, and the United Fruit Company and the Panama Railroad and Steamship lines connect with the boats of the Peruvian and Chilean lines and the Pacific Steam Navigation Company. Vessels plying to east coast ports from New York make no stops in the West Indies, as a rule, except at Barbados, and occasionally Trinidad, and travelers in Venezuela or Colombia who wish to visit Brazil and Argentina often find it more desirable to return to New York than to wait for connections. Pernambuco is the first port of call for the regular liners on the way down the east coast, except those of the Lloyd Brazileiro, and Pará and neighboring ports are reached from Pernambuco by coasting vessels.

River Transportation.— Transportation by river in South America has had the importance which it always has in a new and unexplored continent, and it will continue to be perhaps the chief factor in the development of the interior regions, particularly the Amazon Valley, for an indefinite time to come. Where railways are built they form of course the principal means of carrying traffic, and a steady expansion in railway construction is to be expected. But such construction is attended with great difficulties in the vast tropical regions of the northern and central sections as well as in the mountainous regions of the west coast, and the cost is very heavy. The rivers will, therefore, remain the recognized outlets for these tropical regions until the growth of population makes it feasible and desirable to provide what is now dense forest land with networks of railways.

There are four great river systems in South America on which vessels ranging in size from the small canoe of the Indian to the great ocean liners carry manufactured goods to the interior and bring out rubber, hides and a dozen other tropical products. These are the systems of the Amazon, the river Plata, the Orinoco and the Magdalena. So extensive are these systems that with a comparatively few miles portage one can go by boat except for rapids from Buenos Aires to the mouth of the Orinoco. The great Amazon, of course, leads in the extent of navigable waterways and ocean liners go regularly as far as Manaós and even Iquitos, almost to the boundary of Ecuador. The Parana and its tributaries, the Paraguay and the Pilcomayo, stretch far into the heart of the continent and afford an outlet for the interior plains of Bolivia, Brazil, Paraguay and Argentina. In the north the Orinoco is as yet little utilized because the country it serves is but thinly settled, but the grassy plains through which it flows will support millions more cattle than they do, and until railways are built to the coast their only outlet will be by way of the river. In Colombia the Magdalena forms the only highway by which freight and passengers move from the interior of the country to the Atlantic Coast and vice-versa.

Navigation on the Amazon, in many respects the most remarkable river highway in the world, is carried on by ocean liners, particularly the boats of the Booth Line and the Lloyd Brazileiro, by a number of river companies and by a host of larger or smaller vessels not grouped into companies. The principal river company is the Companhia Navegação do Amazonas, a Brazilian company, which owns some 50 or 60 vessels. The principal port is that of Manaós, about 1,000 miles from Pará, on the Rio Negro near the place where it empties into the Amazon. On the Madeira there is continuous navigation to the beginning of the rapids at Santo Antonio, and beyond these series of rapids, which are spanned by the Madeira-Mamore Railway, boats of light draft can run almost to the foot of the mountains. On the Amazon itself the line of navigable water for large-draft boats passes the frontier of Peru and continues on to Iquitos, and much farther for those of smaller size. Another highly important river in Brazilian transportation is the São Francisco, which rises in the state of Minas Geraes and flows north for more than a thousand miles before turning east and south to the Atlantic. Rapids and falls prohibit through navigation, but there is a stretch of about 800 miles between Pirapora and Sobradinho over which boats of considerable size can operate.

The Uruguay River does not offer much in the way of transportation facilities, as rapids at Salto stop the boats going up from Buenos Aires. The Paraguay, however, is open as far as the draft of vessels will permit them to go, and steamers of the Lloyd Brazileiro call regularly at Corumba on the Bolivia-Brazil frontier. These boats and also those of the Mihanovitch Line (Argentine Navigation Company, Ltd.) offer a river service to Asunción, Paraguay, the trip up the river from Buenos Aires taking about five days and that down-river about four. This company, which has a fleet of some 300 vessels, does an extensive coasting business to Argentine ports and maintains a daily express service between Montevideo and Buenos Aires.

On the Orinoco, as noted, traffic is light because of the fact that the plains through which the river flows are as yet but sparsely inhabited. There is considerable difference in the level of the river in the rainy and the dry seasons and when the floods come it overflows its banks and its width increases to several miles. The principal city, Ciudad Bolívar, is reached by vessels engaged in ocean trade, and the river is navigable for large boats during high water as far as San Antonio. In western Venezuela the large expanse of lake Maracaibo affords a highway over which the important coffee production of the interior reaches the outside world, but a bar at the entrance keeps out all but light-draft boats.

The Magdalena River, in Colombia, may be said to be the life-line of the country's commerce. Practically all imports destined for the interior are carried over it. Although it is silted up at the mouth so that ocean liners cannot pass through, cargo is discharged at Cartagena and Puerto Colombia and is taken thence by rail to the river ports of Calamar and Barranquilla. It is then loaded on river boats (which also carry passengers) and carried up the Magdalena to the various river ports, from which it is taken inland by muleback or rail. If destined for the capital, Bogotá, it must be transferred to railway trains at Honda or La Dorado and then reloaded on river boats at Beltran, after having encompassed a series of rapids in the river. It then goes by river to Girardot, 93 miles, and finally arrives at Bogotá after another journey by rail, during which it must be transshipped from a medium-gauge to a narrow-gauge railway. From the time it arrives in port, therefore, until it reaches Bogotá the cargo is transshipped six times. The whole trip up-river to Bogotá takes 8 to 10 days, but the down trip can be made in less time during periods of high water. The Cauca River, the principal tributary of the Magdalena, is navigable over part of its length, but rapids and falls prevent the river boats from running through to the Magdalena. Railway construction may in time provide a quicker and more convenient outlet for the country's products, but this is not likely to be accomplished for many years.

MEXICO AND CENTRAL AMERICA.

Central America has owed much of its ocean-transportation service to the development of its banana industry, as this has brought about the establishment of the steamship lines of the United Fruit Company. The vessels of this company have provided the east coast of Central America with a service to United States ports more frequent and regular than is enjoyed by any other section of Latin America. Large ships carrying as a rule both passengers and freight sail regularly between the United States and Central America, as well as Colombia and Cuba, giving direct connections between these countries and five United States ports. From New York there are two sailings each week for Panama (one of these boats also making Port Limon, Costa Rica), and one sailing every two weeks for British Honduras, Guatemala and Spanish Honduras. From Boston there is a weekly boat to Port Limon, stopping at Havana, Cuba, on the way. From New Orleans there is a boat each week to British and Spanish Honduras and Guatemala and another to Panama and Costa Rica, while a third sails for Panama by way of Havana. Service is also offered from Galveston and Mobile, though no passengers are carried, as they are on all the other routes. These boats, carrying millions of bunches of bananas from Central American ports every year, as well as cacao and other produce, afford an adequate and valued service of immense importance to the prosperity of Central American countries, all of which are reached directly except Salvador and Nicaragua.

Besides the United Fruit Company lines serving the east coast from the United States are the Bluefields Fruit and Steamship Company, operating between Bluefields and New Orleans, affording the only regular steamship communication of eastern Nicaragua with the outside world; the Orr-Laubenheimer Line, the vessels of which operate between Mobile and ports of British Honduras and Guatemala; the Hubbard-Zemurray Line running fruit steamers from Mobile to Puerto Cortes, Ceiba and Tela, Honduras; and the Independent Steamship Line, with sailings twice a week for Ceiba, Honduras.

Before the war the Hamburg American Line (Atlas Service) had weekly sailings between New York and Port Limon, and also a semi-monthly service from Port Limon to Hamburg. The Elders and Fyffes Line formerly carried bananas from Costa Rica to Bristol, England, but the vessels were taken over by the United Fruit Company, which continued the sailings via Colón and Jamaica. The French Compagnie Générale Transatlantique maintained a semi-monthly service between Colón and Port Limon and Havre before the war, but sailings under war conditions have been uncertain. Besides this line connections between Panama and Europe are normally afforded by the Leyland and Harrison Line and the Royal Mail Steam Packet Company to England, La Veloce (Italian) to Genoa, and the Compania Transatlantica de Barcelona to Spanish ports.

On the Pacific coast Central America is served by five regularly operating lines, the Pacific Mail, the line of W. R. Grace and Company, the Salvador Railway and Steamship Company, the Jebson Line and the California South Sea Navigation Company. The first-named line operates between Balboa and San Francisco, touching at intermediate ports of importance, the second between Seattle and Balboa and the third between Salina Cruz, Mexico, the terminus of the Tehuantepec Railway, and Balboa. The Jebson Line and the California South Sea Navigation Company operate out of San Francisco, the former with steamers every three weeks and the latter every 10 days for ports to the south. Before the war the vessels of the Kosmos and Hamburg American lines called at Central American ports on their way to Europe. All the above lines serve Mexican west-coast ports as well as those of Central America, and in addition the Pacific Coast Steamship Company has sailings from San Francisco to Mexican ports.

To Mexican east-coast ports four or five lines offer direct regular service from New York, and others take cargo for transshipment. The New York and Cuba Mail has a weekly service to Vera Cruz, Progreso and Puerto Mexico, and the American and Cuban Steamship Line and the Atlantic Fruit Company serve Vera Cruz, Tampico and Frontera with frequent sailings. From New Orleans and Mobile three or four lines have weekly sailings to the chief east-coast ports of Mexico, and there are also a large number of tramp steamers plying between Mexican and United States Gulf ports. Several oil companies also operate tank steamers out of Tampico to United States and European ports. In normal times Dutch, British, German and other steamers afford a frequent service to Europe.

Lake and river transportation has not been extensively developed in Mexico or Central America, as there are no interior waterways of great importance. In Guatemala a certain amount of traffic is carrried on over Lake Izabal, and in Nicaragua Lake Nicaragua, Lake Managua and the San Juan River form a water highway that is considerably used. In Mexico the Panuco River, leading back from Tampico, is navigable for many miles.

Interior Transportation.—A casual study of the map will disclose that South America, although discovered by white men over 400 years ago, is as yet in large part only fringed with settlements, and the heart of the continent remains as it was before Columbus sailed. All along the coasts are scores of towns and cities, mostly commmunicating with each other and the outside world by water, which serve as inlet and outlet for the commerce of a comparatively narrow hinterland. In some cases the towns and villages of this hinterland are reached by railways, in others by river boats; but very often the only communicating road from the coast is a rough trail, where even wheeled vehicles will find no thoroughfare. Even where rail or river transportation is well developed the terminal towns serve as distributing centres for settlementa still farther in the interior, which must be reached by primitive means. These interior towns are not heavy consumers of manufactured goods from abroad, or at least the variety of such goods in demand is not wide. But such lines as cotton goods, boots and shoes, farm implements, house furnishings and hardware of various kinds, particularly cutlery, move constantly to the interior when they can be obtained from abroad. It is also a mistake to consider that these outlying villages offer no special market for luxuries or for articles usually associated with urban life. An American company has placed sewing machines in the houses of poor Indian laborers, and one instance is known where an American soda fountain was imported, although the drums of carbonated water to be used in it had to be carried regularly 100 miles or so by muleback. As a rule the American manufacturer exports his wares to South America in the same way as the German, British or other European manufacturer, that is through an export commission house, which attends to transportation details. Even where he ships direct his goods in most cases go to a native importing house in some large port, and this house, long established in the field, has its own connections with merchants of the interior. It will nevertheless be worth his while to make such study as he can of the ultimate consumer in South America, and, if opportunity offers, to trace his goods by personal visit to their final destination in mountain or forest home. The necessity for complying closely with requirements as to trifling details in color or construction, for packing in containers of a certain weight and quality and for being liberal in granting credit terms to importers will undoubtedly be more clear to him after such visit.

The distributing centres for foreign goods in South America are in most cases coast cities at which the ocean liners discharge the cargo destined for the general region which they serve. Along the coast of Brazil there are six or eight of these centres, including Pará, Pernambuco, Bahía, Rio de Janeiro and Santos, and to a lesser extent Rio Grande do Sul, Porto Alegre, Florianopolis, Victoria, Maceio, Fortaleza, Paranagua and others, while Manaós, over 900 miles up the Amazon, is for all practical purposes to be considered an ocean port. From these cities goods are distributed by coast vessels ranging in size from those of several hundred tons to the small sailing vessels or motor boats, which make the numerous small ports in between the larger centres, and from these the goods work their way back into the inland villages. In Uruguay all lines radiate from Montevideo and in Argentina Buenos Aires is the great open door to the whole interior. Goods destined for Patagonia may be routed by way of Bahía Blanca or Punta Arenas, but the greater part of imports for this section also will probably be found to pass through Buenos Aires. Along the Chilean coast are many nitrate towns and cities, each of which lives an independent existence, obtaining all its supplies from visiting ships. Besides three railway lines running to the Pacific, Bolivia is reached by two or three routes running up from the river Plata. This is the historic road over which a great amount of traffic passed in the Spanish colonial days, and it is still a convenient pathway for supplies going to eastern Bolivia. The route lies through either Buenos Aires or Rosario, then by rail to the border at La Quiaca, then by cart or animal to Tupiza, 57 miles, or to Tarija, 82 miles, and then by such conveyance as offers to the final destination. Goods often reach the cities of Sucre or Potosí in this manner. Throughout all the region known as the "montaña" district, embracing eastern Bolivia, Peru, Ecuador and western Brazil, the method of moving produce is the same — that is, by rail, ocean steamer or river boat as far as these conveyances can take it, then by muleback, llama back or man power to the village in the mountain or forest. This is true also of Colombia and Venezuela and the Guianas, to the north, where the general absence of rail transportation makes the mule a necessitv in communicating with most districts off the coast.

In all South America there are hardly any extensive highways built and maintained with substantial paving materials, such as are common in the United States and Europe. Wheeled vehicles are mostly carts, which are used in many places to bring the country produce to market and to do heavy hauling in the towns and cities. This lack of roads is due in part to the expense of constructing them, in part to the general disposition of South Americans to allow foreign enterprise to develop their resources. There is, however, a very widespread interest in the subject of good roads, and several governments have included substantial sums in their budgets to be devoted to building them. It is likely that the continent is on the eve of an era of extensive highway construction, one of the things now most needed to open up the resources of the various potentially wealthy countries. The coming of the automobile is to be credited with much of the interest now being displayed in good roads.

Of the beasts of burden used to transport freight into the mountainous districts of the Andean highlands the llama is most distinctive but the mule is most useful. The llama is not a strong animal and can carry only about 100 pounds. It is very tractable and finds its own forage by the wayside. It knows its load, however, and will usually refuse to go on if a few pounds extra weight are added to its burden. The mule carries as much as 250 pounds at a load, but as the pack is arranged so as to distribute the load evenly on each side it adds greatly to the convenience of the importer to have the goods in cases of 120 or 125 pounds each. Packages should not be over three feet long, or 14 inches in other dimensions. Indians carry heavy loads on their backs and go long distances with little to eat, although a pouch of cocoa leaves on which to chew is considered practically a necessity.

Conditions in Central America are practically the same as in South America so far as interior transportation goes, although in one case at least an excellent automobile road has been built. This is the highway called "Carretera del Sur," 90 miles long, leading from the Pacific coast of Honduras to Tegucigalpa. There is much interest in road building in Honduras, but comparatively little construction of a permanent character has been effected. In Mexico road building and railroad construction have made much more advance, but mule trains are used throughout the country, particularly for carrying supplies into mining camps and bringing out ore.

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7. INDUSTRIAL DEVELOPMENT AND COMMERCIAL PRODUCTS OF LATIN AMERICA. Latin America is the most promising of the undeveloped sections of the world. The North Temperate Zone has been peopled and developed. Europe with 3,875,000 square miles has 465,000,000 people, or 120 per square mile. Asia with 17,000,000 square miles has 870,000,000 people, or 50 per square miles. North America with 8,600,000 square miles has 140,000,000, or 16 per square mile. Africa with 11,600,000 square miles has 150,000,000, or 12 persons per square mile; South America with 7,600,000 square miles of area has but 56,000,000 people, or 7 persons per square mile. Add to South America, Mexico, Central America, Cuba and the island of Haiti, and we find that Latin America has 8,660,000 square miles, 82,000,000 people and 8 persons per square mile. North America has 315,000 miles of railway, Europe 227,000, Asia 62,000, South America but 49,000, and Latin America as a whole, 70,000. Europe has a commerce of $25,000,000,000 per annum in normal years; North America, $6,250,000,000; Asia, $4,200,000,000, South America $2,250,000,000 in her best year, 1913, and all Latin America $2,900,000,000.

The three great requirements of man are food, clothing and manufactures. The North Temperate Zone has been pretty well developed as to its producing powers and is looking to the South Temperate Zone and Tropical America for food and manufacturing materials. The food demands of the Temperate Zone people are chiefly bread and meat, and the Tropics at present do not produce enough of these for their own use. And there are only three places in the South Temperate Zone to which to look for products of this character, namely, South America, Australia and New Zealand. All of Argentina, all of Uruguay, two-thirds of Chile and the southern parts of Brazil and Paraguay are temperate. They grow wheat, corn and maintain enormous herds of cattle and sheep, and Argentina is now beginning to develop the swine industry. In addition to this the great elevated region of the interior of Peru, Bolivia, Ecuador and Colombia is capable of producing Temperate Zone products, the extreme elevation giving it a temperate climate even under the Equator. Argentina, Uruguay, Chile and Mexico together produce about 225,000,000 bushels of wheat a year, while Australia and New Zealand, the other South Temperate Zone wheat producers, seldom turn out more than 100,000,000 bushels a year. Of corn, Argentina is next to the United States in rank in the quantity of corn produced, and actually exports more corn than we do, and Mexico 75,000,000 bushels, while Australia and New Zealand produce but very small quantities. Of meats Argentina alone exceeds Australia and New Zealand in combination, her supply of cattle being about 30,000,000 against 13,000,000 in Australia and New Zealand. Mexico and Central America have normally about 10,000,000. Of sheep Argentina has 83,000,000, Australia 82,000,000 and New Zealand 25,000,000, though the number of sheep slaughtered for food is small, most of them being retained for wool production. Of swine Argentina has about 3,000,000 while Australia and New Zealand have about 1,000,000. Brazil has as many cattle as Argentina, 30,000,000; Uruguay 10,000,000, other countries of South America about 20,000,000, and Mexico and Central America 10,000,000, making for all Latin America about 80,000,000 against 20,000,000 in Australia, New Zealand and South Africa. The total number of cattle in all the world is but about 500,000,000. About 125,000,000 of these are in India which does not utilize them for food, so that Latin America has now over one-fourth of the world's supply of cattle usable for food. And when we remember that Latin America has at the present time but an average of 8 persons per square mile against 20 persons per square mile in the United States and 120 per square mile in Europe, it will be seen that her possibilities of a large increase in the future are very great, both in the matter of meat supply for the outside world and that of grain, for Argentina in 1913 held fourth rank as an exporter of wheat, and was also the world's largest exporter of corn. Of sugar Cuba is the world's largest producer, her exports in 1918 in sugar alone amounting to about $246,000,000.

In one other important article of food supply South America outranks all other parts of the world combined. This article is coffee. Brazil alone produces not merely more coffee than any other country, but actually more than all the rest of the world put together. In fact Brazil's output of coffee amounts to about three-fourths of the world's supply, while several other of the Latin-American countries produce considerable quantities of this important world crop. The total world output of coffee averages about 2,500,000,000 pounds per annum, and of this Brazil produces three-fourths and Latin America as a whole produces four-fifths. And when we remember that the coffee crop of the world amounts to about $350,000,000 per annum in value in the countries of production we begin to realize the value of Latin America's production of this article of commerce. The cacao crop of the world amounts in value to about $100,000,000 per annum, and Latin America produces about one-half of this, divided between Ecuador, Brazil and the West Indian Islands, the Ecuador crop amounting to about 100,000,000 pounds a year, and that of Brazil about 75,000,000. Of flaxseed, or linseed, as it is usually termed in commerce, Argentina produces about one-third of the world's supply, the total world crop usually amounting to about 130,000,000 bushels, while Argentina alone produced 44,000,000 bushels in 1913, though the crop of 1916 was very small owing to the extreme droughts which adversely affected many of the agricultural products of that country.

Wool, hides, rubber, tin and copper are Latin America's chief contribution to the manufacturing requirements of the world at the present time, and the output of copper on the western coast of continental Latin America has greatly increased in very recent years. The relative rank of the Argentine and Uruguay in the world's supply of wool and hides is indicated by the figures above quoted of sheep and cattle in the same countries compared with those of other parts of the world, as above presented. In copper production Chile holds second rank as a world producer, and rapidly increasing its output through the great mines owned by American capital, though her output is small as compared with the United States, which still supplies over one-half of the copper of the world. Chile has also the world's chief supply of nitrate. Mexico and Peru are considerable producers of gold and silver.

Bolivia supplies about one-fifth of the world's tin, and has very large supplies yet undeveloped. In India rubber, Brazil formerly held first rank in world production prior to the recent wonderful development in the production of plantation rubber, but her output of forest rubber is declining by reason of the enormous supplies of plantation rubber now entering the world markets. Of cotton considerable quantities are grown in Brazil, Peru, Chile, Mexico, Colombia and the northern part of Argentina. Tobacco is grown in great quantities, that of Cuba alone amounting to about $25,000,000 a year.

Latin America has a more promising future than any of the other great undeveloped areas of the world. It is, as already shown, a large producer of many classes of foodstuffs and manufacturing material for which the world is clamoring, its fertile area is larger in proportion to its entire extent than that of any other of the undeveloped continents, and the present population per square mile is smaller than that of any other of the continents except Australia which has a much larger percentage of desert than has Latin America. The greatest lack in natural supplies is in coal, of which she has but small quantities, found chiefly in Chile, but the recent developments in fuel oil production in Mexico and the mountain regions of the west coast of South America, coupled with the increasing use of the splendid water powers for the production of electricity, promise to minimize the disadvantage due to this lack of fuel supplies.

Latin America's greatest requirement at the present time is capital for transportation facilities and for the development of the great agricultural and mineral resources which will become available with facilities to transport the natural products to the navigable streams of which South America has the world's greatest supply and thence to the ocean where steamships are available to transport them to the waiting markets of the world. The lessons of the war have shown that the horseless vehicle and flying machine can now be successfully used over areas in which no modern roads exist, and the development of the motor for farm purposes has shown how agriculture can now be conducted in the tropics without the aid of the horse. These things point to a great development in the producing power of Latin America in the near future.

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8. MINERAL INDUSTRY IN LATIN AMERICA. The known mineral riches of Latin America exceed those of any other part of the globe so far explored. The entire supply of the world's bismuth comes from Bolivia; by far the largest supply of thorium is furnished by the monazite sands of Brazil; the unparalleled nitrate deposits of Chile supply practically all of the world's consumption of nitric acid, and quite all of its consumption of iodine; Colombia is the only considerable source of platinum outside of Russia; the tin production of Bolivia stands second on the world's tally sheets; Colombia supplies the world's demand for fine emeralds; Brazil is second only to South Africa in the production of diamonds, and for many years was first; the asphalt lakes of Trinidad and Bermudez supply the world.

In striking contrast to the prodigious wealth awaiting development in Latin America is the notably disproportionate enterprise with which it has been attacked. The most serious hindrance is the lack of transportation, and, comparable with this, the scarcity of water and dearth of fuel. The preliminaries of new undertakings in the mineral country require the investment of very substantial sums, and explains why the active mines in the whole region are those which have been in operation for centuries, and why the vast mineral treasure of the less accessible places is left to the exploitation of the individual native miner.

The mineral belt of Latin America is centred upon the great continental backbone which in the United States and Canada bears the general name of "The Rockies." In Mexico it is a broad zone traversing the entire country from northwest to southeast. Through Central America it is lower in altitude and with apparently fewer treasure spots. In South America it appears again as the Andes, following along the entire western coast. Other smaller areas add their tribute, notably the coastal uplift of southeastern Brazil, known as the great Brazilian plateau. Glaciers and other erosive agencies have scattered far and wide their grindings from the mother lodes, so that the territory available for profitable exploration and development is, broadly speaking, boundless; and somewhere within the region may be found every mineral having commercial value.

The disturbed conditions in Mexico and the influences of the European War upon the mineral output of South America from 1914 to 1918 make it impossible to present an accurate survey of Latin America's potential production of any of the metals. The most that can be done is to show what the actual production was under these great disadvantages.

Gold.— In Mexico and Central America almost all the mining of gold is from the lode. In South America much the greater output is from the placers which for centuries have been accumulating fragments from lodes of unrivaled richness high up on the slopes of the Andes, and as yet undiscovered. The stores of gold and golden objects carried away from the Inca and Aztec chiefs by Pizarro and Cortes were doubtless the accumulations of many years, and in all probability were the product of the placers. Under the viceroys a very large amount of gold and silver was obtained under a system of forced labor at no expense to the taskmasters. In Bolivia alone the great placer deposits have been worked since the middle of the 16th century and are estimated to have produced $2,500,000,000. About the middle of the 18th century the leading gold producing country of the world was the southeastern highland of Brazil in the present state of Minas Geraes. The workings were mainly placer, but there were some lode mines. Some of the more remarkable yields of mining under modern methods are: Butters (Salvador), $4,138,050, on a capitalization $729,000; Dos Estrellas (Mexico), $10,335,000, on a capitalization of $150,000; Mexico Mines of El Oro, $4,458,745, on a capitalization of $875,000; Penoles (Mexico), $6,361,687, on a capitalization of $180,000; San Rafael (Mexico), $1,442,380, on a capitalization of $60,000; Sorpresa, $3,979,240, on a capitalization of $384,000.

Figures which give a fair comparison of the relative annual gold production of the countries of Latin America follow:

Argentine	$107,300
Bolivia	175,000
Brazil	3,570,000
British Guiana	879,000
Chile	731,000
Colombia	2,971,700
Costa Rica	1,021,629
Cuba	28,000
Dutch Guiana	571,100
Ecuador	406,500
Fench Guiana	3,050,000
Honduras	1,000,000
Mexico	20,500,000
Nicaragua	1,100,000
Peru	492,000
Salvador	1,245,000
Uruguay	111,000
Venezuela	623,500

Upon the breaking out of the European War in 1914, the demand for metals other than silver and gold lessened considerably, so that large numbers of men found their way to the fields yielding the precious metals. The effect was most marked in the yields of Colombia and British Guiana, the former increasing to $4,678,000 (nearly 60 per cent), and the latter increasing to $1,126,515 (28 per cent).

As to the immediate outlook it may be said there are enormous gold-bearing deposits on the summits and slopes of the Peruvian and Bolivian Andes, and this section is probably richer than the most productive area now being worked anywhere in the Western Hemisphere. Glacial moraines miles in extent show gold in paying quantities, and great alluvial "pampas" are equally rich. In addition, gold may be picked out of every stream flowing down to the lowlands. In the Nechi and Condoto rivers in Colombia dredges are at work, the yield ranging from 20 to 50 cents a cubic yard, though not yet in the richest section. Drills show that an average of 70 cents per yard prevails throughout a mass of 7,000,000 yards. In 1915 gold to the value of $1,720,000 was taken by two dredges from the Nechi River. The mines of Chiquiaguillo are noted for the unusual size of the nuggets secured, the largest weighting 52½ ounces, of which 47 ounces were solid gold. In the form of lodes gold is found both on the eastern and western slopes of the Andes, the veins often crossing the water courses, and showing an outcrop hundreds to thousands of feet above the base of the ravines. They are traceable for miles, from three to eight feet in width and showing from one to five ounces of gold per ton. The whole country, and this is true also of Mexico and Honduras, is dotted with signs of ancient workings. In Honduras many of these diggings are being worked to-day with the most primitive appliances and yielding surprising returns. In the Brazilian plateau the ore is showing richer quality as the mines are sunk deeper. The Saint John del Rey mine is now the deepest in the world having reached the depth of nearly 5,000 feet. This mine and the Ouro Preto combined have a steady output of about $233,000 a month. Formerly the gold output was mostly placer, and abandoned placer mines are very numerous in Minas Geraes. In French Guiana and Dutch Guiana some of the placer territory has apparently run out, though it is still considered profitable for dredges. With all its potential richness, however, the whole of Latin America is at present yielding only about one-fifth as much gold as is South Africa.

Silver.— Large as has been the total of gold produced by Latin America, the amount of silver has been many times larger. The records do not go back of about 1545, when Europeans found many silver mines yielding enormous quantities, and millions of dollars in silver ornaments, images and objects of art. At the beginning of the 19th century the yearly silver output of Mexico was about $27,000,000; it is now about $45,000,000. The state of Zacatecas alone has produced nearly or quite $1,000,000,000 in silver. The most famous silver mine in South America is at Potosi, Bolivia, discovered in 1545. Fully $3,000,000,000 has been taken from this "silver mountain," and its yearly output is about $2,450,000. Another noted mine is, or was, that at Cerro de Pasco, now equally famous for its enormous copper production, the silver it now yields being what is found in with the copper. Another mine of fabulous richness is that at Valenciana, Mexico, which from 1760 to 1810 produced over $300,000,000. In Colombia several discoveries have been made of ore carrying from 500 to 750 ounces of silver to the ton. In Chile and Argentina silver has been found on both sides of the great eruptive masses of the mountain country, but as yet is little worked. The silver output of those countries is largely that recovered from argentiferous copper ores.

The latest authoritative figures for the silver production of Latin America are those for 1914, as follows:

Argentina	$19,500
Bolivia	2,200,000
Chile	39,600
Colombia	194,300
Ecuador	12,500
Peru	4,618,400
Mexico	39,099,200
Central America	1,330,600

The total of $47,520,000 is about 41 per cent of the entire silver output of the world ($116,719,000) for that year. With the increase of copper mining in Peru, the silver output of that country has risen to about $6,000,000 annually; a part of this, however, comes from the argentiferous lead of the mine at Ancachs.

Copper.—For many years Mexico and Chile have been among the leading contributors to the world's supply of copper, Chile, indeed, having been at one period the largest copper producer in the world. Recently Peru has taken third place in Latin America's copper production, the mines at Cerro de Pasco, long famous for their great output of silver, now being claimed to include one of the largest known deposits of copper ore. From Venezuela mines $15,000,000 worth of copper have been taken in 15 years. In Bolivia also copper mining has developed in many localities, usually in connection with silver mines of long standing. In Brazil some large copper smelters are in continuous operation, and the increased price due to the European war has occasioned the pumping out of the old Cobre copper mine near Santiago, Cuba, which has stood full of water for a century or more. In Guatemala and Costa Rica many copper deposits are found, but few are worked, and these but feebly. Mexico's copper output, which in normal times is about 175,000,000 pounds annually, in 1915 had dwindled to 68,255,676 pounds. In Chile, however, the greatest development has taken place. Fully 2,000 copper mines are in more or less active operation, many of them by individual native miners in localities far removed from transportation facilities, only the richest findings reaching civilization in bags on the backs of mules or llamas. Recent explorations in the region of Chuquicamata have revealed the largest known body of copper ore in the world, estimated to contain at least 700,000,000 tons of ore averaging 38 pounds of copper to the ton. And these figures are completely overshadowed by those of Peru, where the Cerro de Pasco mines are yielding 140 pounds to the ton, besides 11 ounces of silver and nearly one-tenth of an ounce of gold. For 1916 the exports of copper from Chile amounted to 146,605,900 pounds, and from Peru 91,766,475 pounds. Under the stimulus of the war demand and the war prices, vigorous exploration is in progress throughout the whole of western South America, and a very large increase in output may be expected within the next two or three years.

Tin, Platinum and Bismuth.— In the world's production of tin Bolivia holds second place, following the Malay states; the output for 1915 being 21,794 tons — about half that of Malaya, and over four times that of the long famous mines of Cornwall. In several instances former silver mines are now yielding tin ores, the silver having disappeared. Many rich lodes of tin ores have been located at high elevations in the Bolivian Andes, at places remote from transportation lines, and the claim is confidently made that this region holds the largest and most valuable tin deposits in the world. Formerly a large proportion of the tin output of Bolivia was won from placers, and while these are by no means exhausted, lode mining has been found more profitable. The tin exports of Bolivia now exceed a value of $15,000,000 annually. Within the past three or four years tin mining has been developed in Catamarca province, Argentina, and small shipments are reaching the market from that locality. As a matter of fact, tin is found in nearly all parts of Latin America where silver occurs, but the individual outputs are small and do not appear in the records.

Next to Russia, Colombia is the most important source of platinum in the world. Its output in 1915 was about 19,000 ounces, and, as the Russian production had diminished one-half on account of the war, the Colombia production amounted to one-seventh of the world's output. From a value of $44 per ounce in 1914 platinum has risen to $100 per ounce in 1917, stimulating the mining of this metal to the fullest extent. The workings are generally in gold-bearing gravels, and some of these deposits have been found in Ecuador and are being developed. Platinum in small quantities has also been found in the gold placers of Brazil. The crude platinum mineral, as it comes from Colombia, has a very large admixture of either iridium or osmiridium, amounting sometimes to 30 or even 50 per cent.

Very nearly the whole of the world's supply of bismuth comes from the Bolivian mines at Tasna and the Chorolque mountain. At the former locality the deposits constitute the largest known occurrence of bismuth ores. The metal is associated with tin and silver and is nearly all sulphide. At Huayni-Potosi a considerable part of the large yield is native metal. Another locality which has been worked successfully, though in a small way, for bismuth is that of San Gregorio, Peru, and it is known that bismuth is plentiful in other Peruvian territory. For 1915 the Bolivian product was 568 tons, valued at about $1,071,000; the Peruvian output was about 25 tons.

Coal and Petroleum.— The retardation which the mineral industries of Latin America suffer through lack of cheap fuel has already been noticed. The condition is not due to the barrenness of the territory in this primal necessity, but to indifferent development of a natural supply actually abundant. All through the Andes region coal exists in large quantities, and in many localities wide seams are exposed to view for long distances along the slopes and in the sides of ravines, millions upon millions of tons being in sight. Some of these coal veins come down almost to tide water — as at Paracas and near Trujillo, Peru. Good coal is found also along the coast of Ecuador, but it is as yet undeveloped. It is difficult to understand this situation in the face of the fact that in Bolivia coal imported from England brings $40 per ton, and delivered at the Potosi mines, $70 per ton. Although Peru has almost unlimited deposits of both anthracite and bituminous coal, as well as lignite, the only considerable mining done in that country is by the industrial companies which consume it. About 700 tons a day is thus mined, most of it being turned into coke. In Chile, new deposits have been discovered recently in the Aconcagua region near Rio Blanco. In Southern Chile, coal is mined extensively at Lota and Coronel, at the former place the mines running out under the sea for more than half a mile. The yearly output of the three principal mines aggregates more than a million tons. As fuel, the Chilean coal is not of the highest grade, having about 80 per cent of the heating value of the imported British coal. The Lota mines have been worked since 1852. In Colombia, coal is found in many widely separated localities; good bituminous coking coal in the interior, and lignite beds near the coast. No attempt at commercial development has been made. There is more or less coal of fair quality in Venezuela, worked only for local purposes. In Mexico, coal is very plentiful, and the deposits in some cases are of great extent. At one locality in Coahuila a visible supply of 300,000,000 tons has been found. Perhaps the most serious result of the delay in coal development is that under this condition no great iron industry can be brought into being, and without this, the whole country must be at a disadvantage as compared with other sections. The coal production averages annually about 1,350,000 tons for Chile, 980,000 tons for Mexico, 300,000 tons for Peru and 16,500 tons for Brazil.

The petroleum beds of Mexico and Peru are important sources of fuel oil, the Mexican fields occupying fourth place in the records of the world output. The Mexican field at Tampico contains one of the most productive wells ever opened, yielding 105,000 barrels per day. The total capacity of the wells now producing in Mexico is not far from 600,000 barrels per day. The 1915 output is given authoritatively at 35,000,000 barrels. The only considerable active oil production in South America is in the Lobitos fields of Peru; their yearly output is about 3,500,000 barrels. In Bolivia, however, there is an immense oil belt 150 miles long and this continues over the national boundary into Argentina to Comodoro Rivadavia where the Government is pushing development. In Colombia, petroleum has been found in the upper Magdalena district, and at Santander an oil area 100 miles in length and 60 miles in width has been located. It contains many spontaneous oil springs. Another large field has been located in Venezuela near the city of Maracaibo, and in the River Limon district in several places near the asphalt lake oil oozes from the ground. There is also a small refinery in active operation at Santa Elena in Ecuador. On the island of Trinidad the development has reached an output of 700,000 barrels annually. The Guatemala oil fields are controlled rigidly by the Government, and the output is small at present. With exceptional prospects for a great oil industry all Latin America, with the single exception of Mexico, cannot be said to have seen even the first stages of its possible development.

Other Metals and Minerals.— Foremost among the lesser mineral products of Latin America stands nitrate of soda, or "Chile nitrate." The only locality in the world where this invaluable salt is found in considerable quantity is the Atacama desert in northern

Chile, an interior dry valley between the Coast ranges and the Andes. Associated with the nitrate (29 per cent) is sodium chloride (43 per cent), sodium sulphate (5 per cent), and calcium sulphate (4 per cent). A small proportion (1/10 of 1 per cent) of sodium iodate supplies the world with iodine — about 450 tons, valued at about $2,000,000 annually. These nitrate deposits supply not only the largest part of the world's nitric acid for industrial purposes, but also the bulk of the nitrogenous fertilizers for the world's agriculture. With the outbreak of the European war a great demand sprang up for Chile nitrate as a source of the ingredients of explosives, and previous exports were trebled to meet this demand. In 1916 the output of the nitrate fields was about 3,000,000 tons.

Iron, which has been well called the foundation of all modern civilization, exists in enormous quantities and of unrivaled quality throughout all Latin America, awaiting development. In the Brazilian plateau are billions of tons of ore carrying up to 50 per cent of the metal, but coal and transportation are lacking for its successful utilization. Great iron deposits are found also in Chile, and some ore is exported. At Tofo the explorers' drills have blocked out a mass of Bessemer-grade ore calculated to contain 100,000,000 tons. Here, too, a lack of coking coal is holding back development. In the province of Atacama deposits of iron ore aggregating 500,000,000 tons contain gold in the proportion of one ounce up to 16 ounces per ton. In Venezuela a start has been made, and a million tons of 67 per cent ore are being shipped annually. In the southeastern part of Cuba has been located an immense body of iron ore estimated at 300,000,000 tons, carrying 1 per cent of nickel. In 1915 Cuba shipped 830,000 tons of iron ore, and 200,000 tons of manganiferous iron ore. Other important deposits have been found in northern Mexico, Guatemala, Honduras, Colombia and Peru.

After the outbreak of the European War and the consequent advance in the price of antimony from 6 cents to 40 cents a pound, many antimony mines throughout Latin America, unprofitable at the old prices, went into active operation. The effects were most marked in the increase of Bolivia's exports of ore (50 per cent) from 205 tons in 1914 to 19,786 tons in 1915. The antimony ores are found in the same localities as the tin ores, but in different veins. Mexico also has rich antimony deposits, and in normal times exported upwards of 4,500 tons of metallic antimony annually. Since 1911 the production has been greatly reduced.

About half the world's supply of borax is produced by Chile. The western range of the Andes, known as the Cordillera Occidental, traverses Peru, Bolivia, Chile and extends into Argentina. Many of the peaks of this range were volcanoes, and at their bases, at elevations of 12,000 feet above the sea, are a succession of lakes whose waters are saturated with borax, which thickly encrusts their shores and forms a thick pellicle on the surface. Lake Ascotan in Chile is capable alone of supplying the whole world's demand for borax for many years to come. Bolivia and Peru have similar lakes, and in Peru are dry beds of lakes which formerly existed there, now a mass of borax and other salts.

Four-fifths of the world's supply of vanadium is produced by a single mine in Peru, which yields about 3,000 tons annually. The mine has much greater possibilities if there were a larger market for its product.

About one-tenth of the total production of tungsten is supplied by Latin America; Mexico, Bolivia, Argentina and Brazil joining to make up their yearly output of 1,200 tons of 60 per cent ore.

In precious stones, Colombia leads the world with the finest of emeralds of such perfection that they are valued at three times the price of perfect diamonds of equal weight. The mines at Muzo hold the record of having produced the largest emerald known, a stone weighing within two pennyweights of nine ounces. The diamond mines of Brazil have yielded some of the most famous of the world's jewels, notably the «Estrella do Sul» (Star of the South), which weighed after cutting 125 carats, and was sold to the Rajah of Baroda for a figure said to have been close to $15,000,000. Brazil holds the record for black diamonds with a stone weighing 3,150 carats. The diamond fields of Brazil promise profitable returns for years to come, and recent prospecting has revealed new possibilities in a ledge of diamonds in the matrix. Brazil is also rich in aquamarines, topazes and amethysts. A large pearl fishery is in operation in the waters about Margarita Island, employing 1,000 boats and upwards of 3,000 persons.

The largest known supply of thorium exists in the monazite sands of the Brazilian coast, and to this must be added a recently discovered bed of gravel in the interior, estimated to contain not less than 60,000 tons of this scarce and valuable metal.

The great sulphur mine at Tinguirirca, Chile, holds another world's record as the richest sulphur mine known, much of its output being pure native sulphur. For years the Mexican mines at Aguascalientes and Ollague have been producing important quantities of sulphur.

The very important asphalt lakes of Trinidad and Bermudez, each covering an area of more than 1,000 acres, and together yielding a very large proportion of the world's total production of asphalt, is only one more testimony to the marvelous richness in mineral wealth possessed by Latin America. The manganese and zircon of Brazil, the lead and graphite of Mexico, the zinc of Guatemala, the molybdenum and mercury of Peru, the talc of Uruguay, may only be mentioned as of those for which space lacks for detailed discussion. Enough has been told to show that the story of the mineral wealth of Latin America has scarcely begun to unfold, and with so much already known, a mighty development must be looked for in the nearer future. Consult Ugarte, M., 'El Porvenir de la América Latina' (Valencia 1911); Pan-American Union, 'General Descriptive Data' in 20 separate pamphlets, one devoted to each of the Latin-American republics (Washington 1915–17); 'Boletin del Instituto Geológico de Mexico' (Nos. 1–14, Mexico 1895–1900).

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9. COTTON INDUSTRY IN LATIN AMERICA. Cotton production in the Latin-American republics has reached important proportions, the average crop now being 385,000,000 pounds in those countries. Brazil leads with an annual crop of 207,000,000 pounds. The Mexican crop averages 100,000,000 pounds, the Peruvian 62,000,000 pounds, and that of the West Indies 6,500,000 pounds. Venezuela, Haiti and Argentina produce 3,522,000, 3,122,000 and 1,230,000 pounds, respectively. Among the smaller producers are Colombia with 790,000 pounds, the Dominican Republic with 368,000 pounds, Nicaragua 257,000 pounds, Ecuador 250,000 pounds and Paraguay 51,000 pounds.

Reliable information concerning the cotton industry in the southern countries is as follows:

Mexico.—Among the countries of Central and South America Mexico ranks second in the production of cotton. The staple is cultivated on a small scale in many sections of the republic, but the principal cotton lands are found in the states of Tamaulipas and Vera Cruz on the Gulf Coast; Oaxaca, Guerrero, Sinaloa, Sonora and Lower California on the Pacific Coast; and Durango, Coahuila and Chihuahua in the north central section. But at least 80 or 90 per cent of the crop is grown in the central states of Durango and Coahuila, in what is known as the Laguna section. The Laguna lands are said to be of even greater fertility than those of the famous Nile Valley. No fertilizers are needed as there is plenty of nitrogen in the soil, and the Nazas River which irrigates the lands brings down the required phosphates and potash. The fertility of the soil is so great that one irrigation in August or September assures a large crop the next year.

There are no reliable statistics relating to cotton production in Mexico, but the normal crop is estimated at about 200,000 bales of 500 pounds. The unsettled condition of the country, however, has so greatly interfered with cotton cultivation that in 1914–15 the output was only about 145,000 bales. Mexico exports very little raw cotton in ordinary times, but the closing of the mills in Torreon, Durango and other interior towns has forced the cotton planters in the past few years to send a considerable amount of their staple to the United States. Besides these exports from 20,000 to 25,000 bales raised in the Imperial Valley are ginned in the United States from the seed cotton sent across the border.

According to late official figures there are in Mexico 139 cotton mills, containing 762,149 spindles and 27,019 looms. These mills in normal times consume about 162,000 bales of cotton, and employ 34,500 operatives, and the output was approximately 17,605,000 pieces of cloth and 5,002,000 pounds of yarn, valued at $26,548,000 (gold). Most of the mills are fitted for only the coarser grades of goods which find their best customer in the peon. The government levies a direct tax of 5 per cent on all mill sales. Most of the mills are small, the average containing 5,225 spindles and 182 looms. There are only 13 mills with over 10,000 spindles, the largest single mill containing 44,184 spindles and 1,675 looms. The largest group of mills are located in the states of Puebla and Vera Cruz, and in the Federal District. The most important of the mill towns are Puebla, Atlizco, Orizaba and Mexico City.

Before the condition of the country became so unsettled the imports of cotton goods into Mexico showed a steady increase, the requirements of the people growing proportionately faster than the capacity of the local mills for supplying them. In 1908 the total output of the mills was valued at $27,357,000, while the imports were valued at $8,846,000, so that Mexico imported nearly one-fourth of its requirements of cotton goods. The Mexican tariff on cotton goods is among the highest in the world, being exceeded by those of Peru, Russia and Brazil. On some classes of cloth the duty amounts to three times its value abroad, especially on the coarser grades; the imports are, therefore, mostly of the finer grades of cloth, and such specialties as are not made in Mexico. In 1913 the imports of cotton goods from the United States increased to the value of $1,065,000; in 1914, to $1,201,000; in 1915, to $2,261,000; and in 1916, to $4,892,000, and in the eight years from 1908 to 1916, $4,072,000 or 368½ per cent.

Guatemala.— No cotton is produced in Guatemala, but (1917) it contains the only cotton mill in Central America. This mill is owned and operated by an American and is located near Quezaltenango. It operates 6,000 spindles and 150 looms, and manufactures coarse colored cottons and unbleached sheeting, called "manta." The cotton used in the mill is mainly American, but it also uses some Mexican and occasionally a little Peruvian.

Guatemala is the largest importer of cotton goods in Central America, and cotton manufactures make up the largest single import of the country, amounting to about 24 per cent of all imports and in some years to nearly a third. Of this trade previous to the European War England's share was about 53 per cent, that of the United States 24 per cent, that of Germany 18 per cent and all other countries the remaining 5 per cent.

Of the total of $1,735,000 worth of cotton manufactures imported in 1913, the last normal year before the war, Great Britain supplied $778,000, the United States $504,000, Germany $337,000, and other countries $116,000. In 1914 Great Britain supplied $597,000, the United States $311,000, Germany $286,000, and other countries $95,000, of the total of $1,289,000 worth of cotton manufactures. The statistics of the United States Department of Commerce for 1917 showed exports of cotton goods to Guatemala valued at $471,635. The demand is mainly for goods that are staple articles in the United States.

Honduras.— Cotton is not cultivated in Honduras, though the cotton tree, which is indigenous throughout Central America, is found in all parts of the country. But the extreme height of the tree, reaching 20 to 30 feet, makes it impracticable to gather the fibre which is so very short that it is practically worthless for spinning. However, experiments have shown that both the soil and climate of Honduras are highly favorable to the successful cultivation of upland and sea-island varieties of cotton. There are no cotton mills in this republic.

The United States almost monopolizes the trade of Honduras, both imports and exports, and just prior to the European War supplied the country with about 65 per cent of its total imports of cotton goods. The main imports in this class are prints, gray goods, colored and white goods. The United States has the bulk of the trade in gray goods and more than half of that in colored and dyed goods. England supplies most of the white goods, such as bleached muslins, fancy cottons, ginghams and drills. In 1908 our share in the cotton goods import trade was less than 66½ per cent, in 1911 it increased to about 72 per cent and in 1914 to nearly 80 per cent. In 1916 the total value of our trade in cotton goods amounted to $523,688.

Nicaragua.— There is a limited area of Nicaragua that is suitable for growing cotton, and the cotton produced (from imported Mississippi seed) is said to compare favorably with American upland. The greater portion of the country, however, is too mountainous to raise cotton, and the area suitable for cotton, said to be not much greater than 50,000 acres, is confined mainly to the western coast in the province of Chinandega, north of the port of Corinto. In 1908 a crop of 192,026 pounds was produced, in 1912 it increased to 256,344 pounds, but in 1914 the yield was only 12,562 pounds.

Cotton cloth (hand-made) is produced in Nicaragua only in small quantities, the amount imported practically representing all that is used. The cheaper qualities of cotton cloth, such as gray and bleached sheetings, prints, ginghams and drills, make up the greater share of the textile imports. In 1908 the total value of imported cotton goods amounted to $909,000, and in 1913 to $1,022,846. In the latter year England supplied 55 per cent of the cotton cloth imported; the United States, 29 per cent; France, 7 per cent; and Italy, Germany and Spain smaller amounts. In 1914 the imports of cotton goods dropped in value to $828,000, and in 1915 to less than $600,000. In the latter year there were no imports from Germany, and the decrease in the imports of cloth from England amounted approximately to 80 per cent. The value of our exports in 1915 was $259,528, and in 1916 $518,651. In 1917 cotton exports from Nicaragua were valued at $18,859.

Salvador.— No raw cotton is produced in Salvador, nor are there any establishments for the manufacture of cotton. The imports of cotton goods into Salvador are listed as cotton yarn and thread, and as cotton cloth and other manufactures of cotton, and while there are no details as to the kinds of goods imported, the manufactures of cotton form by far the largest importations, being from 33 to 35 per cent of the total. This trade is practically monopolized by Great Britain and the United States. These countries on an average furnish 60 and 30 per cent, respectively, of the total and all other countries 10 per cent. In 1907 the total value of cotton goods imported amounted to $1,153,000, of which Great Britain supplied $653,736, the United States $331,721, and all other countries $167,673, and in 1914 to $1,532,000, showing an increase of about 33 per cent. Of the 1914 total Great Britain supplied $847,724, the United States $462,491, Italy $105,231, and other countries $117,017. In 1916 the imports from the United States increased in value to $735,144.

Costa Rica.— Cotton is not cultivated in Costa Rica, and there are no establishments for its manufacture, and as there is practically no hand-manufacture in the country all cotton wares consumed are imported. Of the piece goods imported, the United States monopolizes the trade in gray goods to almost as great an extent as England does in the sale of white goods. The English also have the largest share of the colored goods trade, while the United States has the largest proportion in the sale of prints. In 1913 cotton goods to the value of $828,948 were imported, of which $355,042 worth came from Great Britain, $243,802 from the United States, $124,699 from Germany and $105,405 from other countries. The cotton imports in 1915 totaled $466,699, and of this $129,848 came from Great Britain, $266,333 from the United States and $70,518 from other countries. The imports of cotton goods from the United States in 1916 were valued at $623,699, an increase over 1915 of about 135 per cent.

Panama.— No cotton is produced or manufactured in Panama, and there is no hand-loom work except possibly on a small scale among the southern Indian tribes. The share of the United States in the trade of Panama has steadily increased since the foundation of the republic until now it buys nearly all that Panama has to sell, and supplies about 73 per cent of her requirements from other countries. Notwithstanding the favorable position held by the United States in the general trade of the republic, for some time prior to 1914 England controlled more than half of the cotton goods trade, the share of the United States being about one-third, the remainder falling mainly to Germany. But a comparison of the imports in 1914 and 1915 shows that the United States gained at the expense of European countries, on account of the war then raging, in nearly all classes of goods imported, Spain being the only European country that increased its exports in 1915. In 1915 the imports from the United States amounted in value to $913,391, and in 1916 there was an increase to $1,396,880, or 53 per cent. The main imports from the United States consist of bleached, unbleached and colored cloths, knit goods, clothing and other wearing apparel, other miscellaneous wares and a small quantity of yarn.

Cuba.— Cuba's imports of cotton goods in the order of value are cloth, knit goods, lace, ready-made clothing and thread. Of the cloths imported the largest takings are white goods, prints, colored goods and gray goods. Prior to the World War, Great Britain supplied more than half the cloths classed as close-woven, followed by Spain, the United States, France and Switzerland. Of loose-woven cloths Great Britain also supplied over half, followed by the United States, Spain and France. The bulk of the knit goods came from France, Germany and Spain, with only a small amount from the United States, laces from Great Britain, with smaller amounts from Germany, France and Spain. Of the wearing apparel imported the United States furnished nearly half, with lesser amounts from France, Austria and Germany. Cotton velvets were imported from Spain and Great Britain, tulle from the latter country and France, piqué from Great Britain, and passementerie from Germany, the United States and France.

Prior to 1900 the exports of cotton goods from the United States to Cuba were a very small proportion of that country's requirements, being a little less than 7 per cent of the total, but beginning with the independence of the island the proportionate share of the United States increased materially, and in 1915 reached 37½ per cent of the total. The cotton-goods trade of Cuba ever since 1900 has been undergoing a marked change. The value of cotton goods sent to Cuba from the United States increased from $4,325,000 in 1915 to $7,742,000 in 1916, being a gain of $3,417,000, or 79 per cent in a single year, mainly due to the war.

Haiti.— A very superior quality of cotton is grown in Haiti, but the crop is small and the quantity uncertain, owing to continuous revolutions and the unsettled condition of labor. In 1914 the exports of raw cotton amounted to 3,121,839 pounds, and in 1917 to 8,381,786 pounds, nearly all of which was shipped to Liverpool. There are no cotton manufactures, all the cotton wares used being imported. There are no statistics relating to the cotton goods imported from the various countries, but as the United States is now controlling about 90 per cent of the import trade, it may be assumed that most of the cotton goods used are obtained from this country.

In spite of revolutions the cotton-goods trade with Haiti shows a gratifying increase in recent years, the total value of such goods exported to that republic in 1916 being $2,275,749, compared with $770,452 in 1915; $1,706,208, in 1914; and $742,978, in 1908.

Dominican Republic.— The cotton-growing district of this republic is in the northern half of the island, principally the provinces of Monte Christi, Santiago and Puerto Plata, and some little planting in the provinces of Espaillat and La Vega. The province of Pacificador also contains much good cotton land. The cotton grown is of the sea-island variety and commands a high price. The cultivation of cotton for export was begun in 1908, and for a time enjoyed considerable prosperity though the production was small. The largest yield was in 1912, but since then the crops have gradually lessened, and in 1914 only 368,439 pounds were exported, and 297,471 pounds in 1915. The cotton wares used in the republic are all imported, as there are no hand-looms or mills for making such goods. The total value of cotton goods imported in 1913 amounted to $1,880,211; in 1914, to $1,232,725; and in 1915, to $1,869,849. The values of the cotton goods imported from each country in 1915 were as follows: United States, $1,377,222; Great Britain, $390,192; Porto Rico, $62,716; Germany, $19,875; Spain, $15,517; France, $4,327. It will thus be seen that the United States controls the bulk of the cotton trade, its share being nearly 74 per cent of the total, while that of Great Britain is 20 per cent, the remaining 6 per cent being divided between Porto Rico, Germany, Spain and France. Cotton exports of 1917 were valued at $32,164.

Virgin Islands, U. S.— In 1913 the island of Saint Croix produced 778,000 pounds of sea-island cotton, but the following year the crop was almost a failure, amounting to only 62,000 pounds. The value of cotton textiles imported in 1914 amounted to $70,006, of which Great Britain contributed $49,838, the United States, $13,798 and Germany, $4,614. The value of imports in 1916, from this country amounted to only $39,398.

Colombia.— A small amount of cotton is grown in Colombia, which is confined to the departments of Bolívar, Atlantico and Magdalena. Most of the cultivated cotton fields lie along the banks of the Magdalena River, between Barranquilla and Colomar. There is also a small amount of cotton gathered from the native wild cotton trees. The staple of the cultivated cotton is one and one-half to one and three-eighths inches, grown from Mississippi seed imported every second year. It resembles sea-island cotton, but the fibre, which is long and silky, is said to be too fine for use in the local mills. This has resulted in the exportation of the Colombian cotton, and the importation of American cotton for domestic manufacture. In 1914 the Colombian cotton sold in the Liverpool market as high as 24 cents a pound. In 1907 the raw cotton exported amounted to 564,242 pounds, and in 1914 to 789,390 pounds. In 1915, owing to the European War, there were no exports, the small crop being consumed by local mills.

According to government statistics (1915–16) there are in Colombia 21 establishments devoted to the manufacture of «textiles and threads,» with a combined capital of $3,530,400. How many of these are engaged in cotton manufactures is not shown, but there are at least four cotton mills of importance, one each at Cartagena, Medellin, Samaca and Bogotá. They operate some 20,000 spindles and 200 looms, and make narrow gray sheeting, drills and thread. Besides these there are four undershirt mills — one at Cartagena, another at Barranquilla, and two at Medellin. There are also hosiery machines at Cartagena and Buga.

Textiles form the largest single item of imports into Colombia, and of these cotton goods are by far greater than all others. In 1908 the total value of cotton goods imported amounted to $6,616,602, the value of the goods received from each country and the percentage share of each being as follows: Great Britain, $3,929,674, per cent 59.5; United States, $1,477,082, per cent 22; Germany, $425,540, per cent 6.5; France, $312,135, per cent 5; Spain, $135,084, per cent 2; all other countries, $337,087, per cent 5. In 1913 the value of cotton goods received from the United States was almost the same as in 1908, amounting to $1,453,774, in 1915 it dropped to $846,793, but in 1916 it was more than three times as much, reaching $2,607,192. Of course this great increase was the result of the disturbance of trade caused by the European War. Colored cloths are the chief item of imports, followed by bleached and unbleached cloths.

Venezuela.— Cotton is grown to a limited extent in Venezuela, most of which is raised near Valencia and consumed by local mills. The staple is strong and silky, and about one and five-sixteenths inches in length. Besides the cotton of domestic growth consumed in the mills, a small quantity was exported prior to the European War, the total in 1908 being 396,885 pounds, which was mostly taken by France, some going to Germany, the Netherlands and the United States. But that the crops of very recent years have been too small to meet local requirements is evidenced from the fact that within the past year the surtax of 25 per cent of the duty on imported cotton has been removed, and now the import tax is only 3.43 cents per pound. There are four cotton factories in Venezuela, operating about 19,000 spindles and 500 looms. They employ 1,800 hands and consume about 6,250 bales of cotton annually. The mills are located in Caracas, Valencia, Maracaibo and Cumaná. These mills make gray goods, coarse wearing cloths, plain sheeting and hosiery.

The cotton-goods trade is the most important in Venezuela, and one in which the United States appears to the worst advantage. Of the total value of this trade in 1908, amounting to $4,191,270, Great Britain furnished such goods to the value of $2,545,536; Germany, $681,530; and the United States, $307,973, the latter's share being only a fraction over 7 per cent. Our share in this trade in 1910 was 7.7 per cent; 1911, 8 per cent; 1912, 10.3 per cent; 1913, 22.6 per cent; 1914, 12.5 per cent; and the first six months of 1915, 20.9 per cent. The items of most importance constituting this trade are in the order named, prints, drills, madapollam, undershirts, checks and plaids, gray shirting, white shirting, hosiery, etc. The imports of cotton goods has been considerably affected by the European War, the value having fallen from $3,907,726 in 1913, to $2,460,525 in 1914, and since 1914 still less than this as indicated by the imports of the first six months of 1915. The exports of cotton goods from the United States to Venezuela in 1915 were valued at $413,203, and in 1916 at $1,114,606, an increase of $701,403, or 170 per cent.

Ecuador.— Cotton is raised in Ecuador south of Guayaquil and also around Ibarra, north of Quito, but to what extent there is no available information. Most of the cotton produced is used in domestic manufacture, and occasionally some little is exported. In 1908 7,317 pounds were shipped to the United States, and in 1914 120,000 pounds to Great Britain. The mills depend upon home grown cotton for their limited supplies, the duty on raw cotton being so high (4.42 per pound) as to prohibit any imports.

Of the imports cotton goods are the most important, forming 24.5 per cent of total in 1908, the value of which was $2,453,900. Of this amount Great Britain contributed $1,573,243, or 64 per cent; Germany, $395,724, or 16 per cent; Italy, $147,020, or 6 per cent; the United States, $106,770, or 4.5 per cent; Spain, $103,268, or 4.5 per cent; and all other countries, $127,875, or 5 per cent, of which Belgium contributed $76,357; France, $34,820; and all other countries $16,698. The principal articles of import are white shirting, prints, gray shirting, knit underwear, cotton trousering, handkerchiefs and hosiery. Cotton goods in general are dutiable at 5.06 cents per pound gross weight, but a few pay special rates. In 1915 the value of cotton goods imported from the United States was $146,854, and in 1916 $498,321, an increase of $351,467, or 240 per cent.

Peru.— Cotton has been one of the chief products of Peru since the time of the Incas, but only within the past 15 years has there been any attempt to increase the acreage and improve the methods of cultivation. Nearly all of the crop is grown on the west coast near the sea and within the valleys formed at intervals between the mountains and the sea by small rivers. The alluvial deposits in these valleys are rich in nitrogen and potash and are very productive. Cotton growing as a rule is very profitable, and hence the area is being increased, and with greater irrigation upon which all of the crops depend and the gradual development of intensive farming the crop is steadily increasing, or was increasing until the European War. The very high freight rates and the limited demand in European countries has been very discouraging to planters, and the crops the past few years have fallen off considerably. The cotton plantations vary in size from 500 to 5,000 acres, are owned principally by Peruvians, and the laborers are native Indians whose average wage is about 60 cents a day. Peruvian cotton may be divided roughly into five staple classifications: The so-called «full rough» cotton, coming mostly from the plantations in the Piura Valley; the «modern rough,» from the districts of Palpa and Uazca; sea-island, largely from Supa; mitififa, grown at several localities along the coast; and «Peru soft,» locally known as Egypto. The rough Peruvian is the indigenous cotton of the tree-cotton variety, and has a strong, rough, wooly, crinkly staple, about one and three-eighths to one and one-half inches long, and its price is largely governed by the price of wool as it is used to mix with wool in the manufacture of «all-wool» underwear, hosiery and cloth. The crop of long-stapled sea-island and mitififa, grown from imported sea-island and Egyptian seed, is small as the staple and quality are found to deteriorate with a consequent lowering of price, which to some extent is governed by the price of Egyptian cotton, a variety it closely resembles. The «Peru soft» or Egypto (a misnomer for it is grown from American upland seed) is much more extensively cultivated than even the native cotton. In the United States it is an annual, in Peru it is cultivated as a biannual, though the second year's crop is about 20 per cent less than that of the first. Its staples run from one and one-eighth to one and one-quarter inches, and its market value is governed by the price of American upland.

In 1902 the cotton crop of Peru was 106,914 bales; in 1905, 139,609 bales; in 1909, 315,640 bales; in 1913, the largest crop ever made. 364,706 bales; in 1914, 346,422 bales; and in 1915, 318,071 bales. The average bale weighs about 170 pounds. The United States consumes annually about 5,654,500 pounds of Peruvian cotton. In 1915–16 the imports amounted to 5,454,000 pounds, but the bulk of the cotton exported from Peru goes to Liverpool. In 1913 the United States exported to Peru cotton goods to the value of $198,331, and in 1916 to the value of $675,686, an increase of $477,355, or 242 per cent. There are seven cotton mills in Peru, five of which are located at Lima, operating 67,900 spindles and 2,293 looms, the capital invested being $2,057,000. These mills manufacture mostly gray sheetings and shirting, gray ducks, ticks and drills and gray and colored checks and striped cloths; also blue drill khaki drills and trousering, ordinary grades of white flannel, and white drills and towels. Outside of the domestic consumption one of the best markets for these goods is Bolivia, and a small quantity is also taken by Chile. The mills consumed 41,177 bales (Peruvian weights) in 1913, 32,353 bales in 1914 and 44,118 bales in 1915.

Bolivia.— Cotton is not grown in Bolivia, nor are there any manufactures of cotton. The imports of cotton goods average in value about $1,000,000 a year, and are largely confined to a few standard lines. The greatest demand seems to be for gray sheetings, white shirtings, printed flannelets and cotton trouserings or cassinettes. In most South American countries Great Britain has controlled about half the cotton goods trade, but prior to 1914 Germany had obtained nearly half the Bolivian trade, Great Britain only about a fourth, the remainder being divided between the United States and Peru, with a small amount going to Italy and France. Most of the gray sheeting used is from the United States and Peru, with a small amount from England. This is the only line in which the United States is prominent in this market, the imports consisting almost wholly of Massachusetts shirtings. Besides these about the only American cotton goods used are small amounts of drills, duck and ticking. The trade in white shirtings is monopolized by Great Britain, and that in printed flannelets was done mainly with Germany, some of the finer grades coming from Great Britain. The cheap cotton trouserings or cassinettes were furnished almost entirely by Germany, as were corduroys, used not only for riding trousers but by the poorer white population for suits, on account of their stout wearing quality.

No detailed statistics of the cotton trade of this republic are obtainable, and hence the proportionate share of the United States is unknown. However, our exports of this class of goods for the fiscal year 1915–16 showed an appreciable gain over the previous year, particularly in bleached and unbleached goods. In bleached cloths the increase was from 110,806 yards to 1,200,944 yards and in unbleached cloths from 1,934,264 yards to 3,069,619 yards, while the value of all cotton wares increased from $146,597 to $366,254.

Chile.— No cotton is grown in Chile, but there are three cotton factories of some importance, operating about 5,000 spindles and 400 looms, besides there are seven or eight knitting mills. These mills make shirts, underwear and hosiery, and a small quantity of miscellaneous wares. Among the South American countries Chile ranks third as a buyer of cotton goods, its annual imports for some years prior to the European War averaging over $11,000,000 in value. Cotton goods form the largest single item of the imports, the value of which amounted to $11,442,939 in 1905, to $13,262,180 in 1907, to $12,214,864 in 1909, to $9,025,176 in 1913 and, due to the war, to only $6,324,368 in 1914. There are no very recent statistics showing the share of each country in the imports.

Among the principal imports, in the order of value, are colored and dyed goods in general, white shirting, knit goods, prints, drills, yarn, gray sheeting, osnaburgs, sewing thread, flannel, passementerie, lace, oxfords, bed-covers, handkerchiefs, ticking, cotton waste and cotton blankets. The trade of the United States, at the period named, consisted mainly of osnaburgs for making flour sacks, flannel, gray sheeting, sail duck, white goods and yarn. The value of the cotton goods exported from the United States to Chile in 1914–15 was $639,031 and $1,638,043 in 1915–16, an increase of $999,012, or 156 per cent. This increase was mainly confined to bleached, unbleached and colored cloths, the exports in 1914–15 being 6,780,257 yards, as compared with 12,211,220 yards in 1915–16.

Argentina.— Cotton cultivation has been undertaken on a small scale in Argentina for some years. There are large tracts of land in the northern and northwestern section of the country that are well adapted for cotton, but for lack of experience, capital and sufficient labor, the crop has made little progress. The provincial governments and various agricultural societies have tried to encourage cotton growing by offering prizes at agricultural fairs, and in 1913 the province of Corrientes granted partial exemption from taxation, and a bounty for picking cotton. Most of the cotton grown in Argentina comes from the territory of Chaco, where European farmers are doing most of the planting, employing native Indians and peons from Paraguay and the province to pick the cotton. There are also small areas devoted to cotton in Córdoba, Santa Fé, Corrientes and several other provinces. In 1907 the exports of raw cotton amounted to 116,767 pounds; in 1912 to 1,230,000 pounds; in 1913, to 750,000 pounds, and 1914, to 609,500 pounds.

There is (1917) one cotton-spinning mill in Argentina with 9,000 spindles, and five cotton-weaving mills with a total of 1,200 looms. The spinning mill has a capital of $850,000, and consumes from 650,000 to 750,000 pounds of raw cotton annually, most of which is imported from the United States, and small quantities from Brazil and Peru. The capacity of this mill is about 1,100,000 pounds of yarn. The five weaving mills have a capital of $730,000 and employ 1,415 operatives. The production of the mills is figured at 8,000,000 to 10,000,000 yards annually, comprised mainly of duck, canvas, gray sheeting and shirting, and a small amount of colored goods. There are also 43 knitting mills with 650 machines, with a yearly production of about 4,000,000 pounds.

The most important single item imported into Argentina is cotton goods. Of this trade prior to 1914 Great Britain controlled about half, the remaining half being competed for by Italy, Germany, France, Belgium, the United States, Spain and other countries. As indicating the share of each country in this trade the imports of a typical year is a fair illustration. The total value of the cotton goods imported amounted to $27,119,134, and of this Great Britain furnished $13,428,662, or 49.5 per cent; Italy, $5,403,737, or 20 per cent; Germany, $3,731,172, or 14 per cent; France, $1,623,565, or 6 per cent; Belgium, $916,788, or 3 per cent; the United States, $685,207, or 2.5 per cent; Spain, $663,266, or 2.5 per cent; and all other countries, $666,737, or 2.5 per cent.

Piece goods form the bulk of the cotton manufactures imported, and most of these are classed as colored goods, which include both goods made with dyed yarn, usually known as colored goods and piece-dyed goods. Other piece-good imports, in the order of their value, are printed, bleached, and gray goods, especially of cotton and wool mixed cloths for trousering, women's skirts, etc. In addition to piece goods the other chief imports of cotton manufactures are cotton yarn, hosiery, lace handkerchiefs, bed covers, blankets, cotton flour bags, haberdashery, duck and canvas, ready-made clothing, ribbons and tapes, and towels. Heretofore the trade of the United States was confined chiefly to cotton flour bags, yarn, duck and canvas, with a small amount of ready-made clothes, gray drills, madapollams and candle wicks. But since the beginning of the European War this country has made extraordinary gains, especially in the exports of bleached, unbleached and colored cloths, knit goods and yarns. The increase in the value of each of this class of goods in 1915–16 as compared with 1914–15 is as follows: bleached cloths from $11,612 to $225,716; unbleached cloths, $178,179 to $578,663; colored cloths, $14,344 to $796,786; knit goods, $169,572 to $1,686,512; yarns, $475,528 to $2,183,809, while the total of all cotton goods increased from $1,064,265 in 1914–15 to $6,495,724 in 1915–16. This shows a gain in one year of $5,431,459, or 510 per cent.

Paraguay.— There is considerable land in Paraguay very productive and well adapted to cotton raising, but the lack of labor, the lack of a home market, high freight rates abroad and the fact that other crops pay better have tended to restrict cotton production. What little cotton there is made is grown partly from the indigenous tree cotton, which bears for several years without replanting and yields a strong fibre about one and one-fourth inches in length, and partly from imported American seed which gives a fibre one and three-sixteenths inches long and is whiter in color than the indigenous cotton. Prior to 1870 about 43,000 acres were cultivated in cotton. Since that date, as a result of the war in which the country had been engaged, cotton culture has been neglected. In 1905, 18,893 pounds were exported; in 1906, 13,018 pounds, and in 1907, 19,092. The total crop during these years averaged about 51,000 pounds. Experiments during 1915 were carried on with American seed and under the direction of an experienced American planter, the results being very satisfactory. There are no cotton manufactures in Paraguay and prior to 1914 the cotton goods trade was divided between Great Britain, Germany, Italy, Spain and France, the rank of each being in the order named.

Uruguay.— Cotton is not grown in Uruguay, and there are only two or three small cotton-weaving mills with some 300 looms. There is also a small but increasing number of knitting machines for making hosiery. The products of the weaving mills consist of plaid flannelets, known as tartan, a good grade of khaki, Turkish towels, common strips and checks and a small amount of fancy goods. There are no available statistics of the imports of cotton goods or the origin of the same, but a recent report of the United States Department of Commerce shows that the imports of cotton goods for the first six months of 1916 were valued at $967,933. The value of cotton goods exported to Uruguay in 1914–15 from the United States amounted to $126,054, and in 1915–16 to $870,613, an increase in value of $744,559, or 590 per cent. The value of bleached, unbleached and colored goods increased from $20,279 to $145,307; knit goods from $25,609 to $377,810; and yarns from $14,444 to $133,067.

Brazil.— It has been estimated that there are sufficient and available lands in Brazil to produce 40,000,000 bales of cotton; and yet, compared with such possibilities, it contributes a very small share to the cotton commerce of the world. The crops fluctuate from year to year, but in spite of the increasing demand for home consumption, and high protection, production shows little tendency to increase. The tariff on imported raw cotton, 7.27 cents a pound, is the highest in the world, the next highest being Russia with 7.22 cents a pound, Peru with 2.65 cents and Mexico with 1.74 cents.

The unprogressive state of cotton culture is said to be due to the fact that cotton is grown in small patches by small farmers, who till the lands by the most primitive methods, and who have neither the money nor the knowledge to adopt more advanced systems; also, to the lack of transportation facilities. Again, another drawback is the uncertain and irregular rainfall, which is often excessive at the fruiting period and at other times fails entirely, resulting in prolonged drought. Cotton can be raised practically in all parts of the country, but the states producing the largest crops (in the northeastern section) are, in the order of their importance, about as follows: Pernambuco, Parahyba, Rio Grande do Norte, Ceará, Alagôas, Maranhão, Sergipe, São Paulo, Minas Geraes and Bahía. The Pernambuco cottons are in general of long staple, and the arboreous Peruvian varieties predominate. The varieties most cultivated are known locally as quebradinho, creoulo, caiana and governo, especially the first two, both of which are tree-cotton. The crop of this state ranges from 150,000 to 250,000 bales. The states of Parahyba and Rio Grande do Norte are ranked after Pernambuco in cotton production. The tree cotton of these states gives the largest yield and will bear six to eight years. Sea-island cotton also gives good results. The Maranhão cotton ranks second only to the famous sea-island. The varieties most cultivated are the Peruvian and some varieties of herbaceous; the creoulo, quebradinho and the governo being mostly esteemed. The highlands produce cotton trees that bear for 8 or 10 years, and are often 20 feet or more in height. The sandy lands of the state of Ceará produce an excellent cotton, the fibre of which is strong, flexible and silky; the salt marshes produce the acclimated sea-island, and also tree cottons that bear regularly for periods up to 10 years. The herbaceous varieties produce cotton in three to four months. The small state of Alagôas in proportion to its size produces more cotton than most of the other states. In the state of Sergipe the herbaceous cottons predominate, but there are also some of the longer-staples grown. The herbaceous cottons take six months and the tree cottons nine months to bear.

The statistics of cotton production in Brazil are very unsatisfactory and not always reliable, but as nearly as can be ascertained the crop from 1910 to 1915, inclusive, in Brazilian bales (of 176 pounds each) averaged 966,000 bales, the maximum being reached in 1913 with 1,165,000 bales, and the minimum in 1915 with 781,000 bales. On account of the increased domestic consumption, the exports of raw cotton from Brazil have declined considerably in recent years. Back in 1872 as much as 173,115,500 pounds were exported. Nothing like this amount has since been sent out of the country, as the home consumption has continually increased. The exports in 1912 reached 36,980,000 pounds, in 1913, 82,504,000 pounds, and fell to 1,960,000 pounds in 1915.

The spinning and weaving of cotton in Brazil has developed to such an extent in the past 20 years that it is now the most important industry in the country. And it is not only a valuable asset in the prosperity of Brazil, but also a growing factor in its economic development as is evident from the following data very recently compiled by Señor Cunha Vasco, showing the comparative status of the industry in 1905 and 1916:

	1905	1916
Number of mills working regularly	110	250
Number of spindles working regularly	734,928	1,464,218
Number of looms working regularly	26,420	49,648
Number of hands working regularly	39,159	72,943
Annual production in yards	264,749,000	261,520,700
Capital	$48,427,000	$78,756,000
Value of output	30,260,750	59,783,750

The annual consumption of cotton per spindle is estimated at 88.18 pounds, from which it is deduced by Centro Industrial, a commercial association of Rio de Janeiro of high standing, that not less than 129,121,900 pounds of cotton are consumed annually. The leading states in the manufacture of cotton, in the order of importance: Minas Geraes, São Paulo, Rio de Janeiro, Federal District, Bahia and Maranhão. There are from one to a half dozen mills in 10 other states. The goods made in the Brazilian mills are chiefly of the coarse and medium grades. The largest output is of colored goods, followed by gray, printed, dyed and bleached, in the order named. Some of the larger mills are manufacturing the finer grades, part of which compare favorably with the imported goods in both weave and finish. The value of the exports of cotton from the United States to Brazil in 1913 amounted to $386,368, and in 1916 to $782,755, a gain of $396,387, or 103 per cent.

General Trade with United States.— The total value of our cotton trade in 1907–08 with all Latin America, and including the West Indies, amounted to $7,366,526, and in 1912–13, the year before the outbreak of war in Europe, to $15,506,377. This was a gain in the five years of $8,139,851, or 110½ per cent. But just two years following, 1915–16, the total exports reached the value of $38,381,074, a gain of $22,874,697, or a little more than 147 per cent. The statistics contained in the following table give the value of our trade with each country for the fiscal years 1907–08, 1912–13 and 1915–16. It is certainly a gratifying exhibit, every country showing a substantial gain, except Honduras, where there was a loss of 25 per cent. The most conspicuous gains (1913–14 — 1915–16) are shown in the value of the exports to Mexico, Costa Rica, Cuba, the British West Indies, Venezuela, Peru, Chile, Argentina and Uruguay. Of course this was largely due to the total suspension of exports from Germany, and the interruption of the maritime trade of other belligerent European nations. But the American exporter ought henceforth to be prepared to meet any competition, and not part with legitimate trade he has acquired.

VALUE OF COTTON GOODS EXPORTED FROM THE UNITED STATES TO LATIN AMERICA AND WEST INDIES.

COUNTRY	1907–08	1912–13	1914–15	Per cent increase 1912–13 1914–15
Mexico	$782,966	$1,064,895	$4,891,956	359
Guatemala	329,067	427,445	578,579	35
Honduras	333,921	699,506	523,688	....
British Honduras	26,479	131,448	188,017	43.5
Salvador	329,161	407,730	735,144	80
Nicaragua	246,222	349,401	518,651	49
Costa Rica	257,567	293,262	623,699	113
Panama	201,957	1,122,185	1,396,880	24.5
Total	$2,507,340	$4,495,872	$9,456,614	110.3
Increase, dollars	....	$1,988,532	$4,960,742	....
Increase, per cent	....	79	110	....
Haiti	$742,978	$1,465,710	$2,276,749	55
San Domingo	34,570	986,076	1,347,919	37
British West Indies	40,711	960,041	1,973,542	105.5
Dutch West Indies	2,563	104,531	109,556	.5
Danish West Indies	3,648	28,302	34,062	21
French West Indies	655	14,550	93,024	520
Cuba	1,245,822	2,903,372	7,741,671	132
Total	$2,070,947	$6,462,582	$13,576,523	110
Increase, dollars	....	$4,391,635	$7,113,941	....
Increase, per cent	....	212	110	....
Colombia	$624,587	$1,453,774	$2,607,192	79
Venezuela	307,973	376,314	1,114,606	197
Ecuador	106,770	218,232	498,321	133
Bolivia	9,378	295,645	366,254	24
Peru	132,409	188,004	675,686	260
Chile	445,960	808,674	1,638,043	102
Argentina	685,207	538,421	6,495,724	1,107
Uruguay	97,084	146,344	870,613	503
Paraguay	222	3,261	16,360	401
Brazil	373,545	431,368	782,755	82
Guiana	5,104	87,886	282,383	221
Total	$2,788,239	$4,547,923	$15,347,937	237.5
Increase, dollars	....	$1,759,684	$10,800,014	....
Increase, per cent	....	63	237.5	....
Grand total	$7,366,526	$15,506,377	$38,381,074	147.5
Increase, dollars	....	$8,139,851	$22,874,697	....
Increase, per cent	....	110.5	147.5	....

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10. CATTLE AND MEAT INDUSTRY IN LATIN AMERICA. The world demand for meat, and particularly beef, has directed attention to Latin America as the most promising field for its production. Locally, there are but few places in either the northern or southern group where cattle have not been raised with success since the Spanish settlement. Due, however, to the lack of transportation facilities and extensive meat-preserving plants, until recently their great value in export trade was almost entirely in their hides. In consequence, the native stock deteriorated through interbreeding and acclimatization to the tropical and semi-tropical conditions, the result being a non-fat producing animal of small size whose beef was unsuited to the tastes of foreign buyers. But with a foreign demand, and the installation of packing, refrigerating and transportation facilities, cattlemen of the pampas of Argentina early recognized the need of scientific methods. Foreign pedigreed stock has been introduced for cross-breeding, fat-producing feedstuffs have been cultivated, sanitary regulations have been decreed and enforced, inland transportation has been facilitated and markets have been established. The result is that under the stress of war requirements for foodstuffs, Argentina became prepared, along with her sister republic, Uruguay, while the beginning of a powerfully potential export meat trade unfolded itself throughout the southern part of the continent, including both Brazil and Paraguay, with the southern provinces of Chile. The present development has shown that, wherever intelligent encouragement has been given to the cattle industry it has prospered. Cheap grazing land, cheap labor, salubrious climate, luxuriant vegetation, improved methods of refrigeration and transportation, await only the scientific correlation of these elements in the more intensive application of the principles of animal industry to make Mexico, Central America, the West Indies and South America a constant producer of cattle, beef and other meat-producing animals for ages to come.

Argentina.— The Argentine Republic is the greatest livestock country of Latin America. Situated between 22° and 55° of south latitude, it has every degree of climate that the United States has, including a diversity of rainfall. Certain parts, particularly in Patagonia, are semi-arid, and deducting these, along with the foot-hills of the Andes, and 90,000 square miles under cultivation, from the whole area leaves an estimated 484,162 square miles available for livestock, an area approximately twice the size of the State of Texas. The number of cattle, officially estimated 1 Jan. 1915, was 30,000,000 — 3.8 per capita — valued at $955,350,000, in addition to 80,000,000 sheep, valued at $203,808,000, 4,564,000 goats, valued at $3,875,748, and 3,200,000 swine, valued at $33,968,000. Of a total of exports amounting to $558,280,643 in 1915, animals and animal products aggregated 218,780,416 gold pesos ($0.965), or $211,516,181.44.

From the days of the earliest settlers the raising of cattle has been the important industry of the country, the immense «pampas,» or prairies, and the salubrious climate being particularly adapted for livestock. But commercially, as far as exports were concerned, cattle were raised chiefly for their hides, the meat being consumed at home, with the exception of a small export trade in dried beef, or «tasajo,» the only form of preservation generally known, and a limited number of stock on the hoof sent to neighboring countries. The result locally was that the inhabitants of Argentina became the greatest consumers of beef in the world, a reputation they still maintain, the per capita consumption being 275 pounds in the cities, and about 300 pounds in the country, as against 112 pounds for Great Britain, 102 pounds for Germany, 80.3 pounds for the United States and 77 pounds for France. The first shipment of refrigerated beef was exported from Buenos Aires to Havre in 1877 — 80 tons. While it was hailed as a success, it was not until the period beginning 1885 that it became of commercial importance. The amount shipped in that year was small — a valuation of only $1,680 — but sufficient to show its commercial practicability, and from that time it has grown to immense proportions, being to-day the greatest staple of the country, and a product that will not attain to its potentialities for years to come. It is sufficiently large at the present time to control the world quotations of meat, and has been responsible for the introduction of hundreds of millions of dollars not only into the exploitation of Argentine industry but that of the entire Rio Plata territory and the whole semi-tropic South America southward.

During the past generation the leading ranchmen, supported by the government in the realization of the need for better beef stock, have imported the best examples obtainable of well-known European breeds, which they have either crossed with the native cattle or kept pure. This movement has taken place largely during the past decade. Considered from all points of view, the Shorthorn has been accepted as the animal best adapted to Argentina's needs, figures from the *Argentine Herd Book* for the year (1917) showing 15,127 bulls and 27,422 cows of this breed. Other breeds are in the following order: Hereford, 2,294 bulls and 4,280 cows; Aberdeen Angus, 1,638 bulls and 2,654 cows; Flemish, respectively 62 and 185; Red Polled, 56 and 71; Jersey, 34 and 41; Red Shorthorn, 17 and 30; and Devon, 4 and 16. This does not represent all the cattle of pedigreed stock, but those registered only. The number, of various breeds, registered in the *Herd Book* from 1908 to 1917 is 60,107 bulls and 66,091 cows, of which approximately 54,000 are alive to-day. From 1901 to 1914 there were brought into the republic 12,761 pedigreed animals, chiefly from Great Britain, valued at $8,000,000, or an average of $637 each. The interest in livestock improvement is so keen that animals of real promise command the highest prices. At the show sale of 1913 at Buenos Aires, the Shorthorn bull, Americus, sold for $33,968, the world's record price, other high figures being Durham Shorthorn (in 1915), $25,476, and the Shorthorn reserve champion (1916), $23,353. The average price brought for 200 bulls auctioned in 1915 was $2,420.

The great majority of stock for breeding purposes is brought from Great Britain, the government regulations being extremely stringent as to the country of origin, the purpose of which is to prevent the entry of stock afflicted with the foot-and-mouth disease and other plagues. The regulations were in fact so strict that it has been, until quite recently, impossible to introduce any livestock whatever from the United States, the fact of the foot-and-mouth disease existing in any part of the country operating as a bar to cattle from any other part; even across the continent where the plague might be unknown. However, at the solicitation of the American Shorthorn Breeders' Association the regulations were modified by decree of 6 Oct. 1915, in the sense that, while importation is prohibited from any country while the foot-and-mouth disease «exists or has existed in an epizootic or general form; or from departments, provinces, countries, or states where the disease exists or has existed within three months previous to shipment, the three months counts from the date of the official declaration of the extinction of the disease, provided that such declaration has not been made until 15 days have elapsed from the last case.» The government feels that it is able now to successfully cope with the cattle plague.

Under the patronage of the government, the Sociedad Rural Argentina — the national organization interested in livestock — holds annual international livestock exhibitions at Buenos Aires, at which prizes for excellence are awarded by a jury sent to Argentina by the Royal Agricultural Society of London, thus maintaining breed standards, the while keeping alive the interest between Argentina and her greatest meat customer. Further encouragement is given to the meat industry by the government agricultural schools, and also by the sending abroad of students, or «becados,» to study veterinary science in leading institutions of France, Germany, Great Britain and the United States. These young men, fresh from the latest and most advanced instruction abroad, return to take up their work on the great ranches or with the department of the government concerned with livestock where they are a strong factor in the promotion of animal industry.

With the exception of those parts of Argentina devoted to agriculture in whole or part, cattle run on immense ranges similar to those of a generation ago in the western United States. Under ordinary conditions but little care is required, the pasturage and climate being favorable. There is, however, the danger every few years of droughts diminishing the supply of water and grass, causing poorly conditioned stock to be rushed to market. The results are commercially bad for the industry, in that the country is depleted of its stock of calves and breeding cows, as is shown by the varying gains and losses indicated in the national census. Of late, however, since the success of the refrigerating packing-houses has been demonstrated commercially, a great acreage has been regularly devoted to the raising of feedstuffs for cattle, the principal ones being corn, 1,250,000 bushels, 1915–16, and alfalfa, known locally as «lucerne,» 18,219,997 acres, 1914. Recently the silo system has been installed as a remedy to overcome the effects of droughts, largely through the encouragement of the railroads. These measures, taken in connection with the improvements in breeding and the increasing world demand for cattle products, promise the continuance and growth of Argentine cattle raising and meat packing.

The packing-houses of Buenos Aires, La Plata and other Argentine cattle markets rank with the best in the world, and in connection with their output a fleet of vessels fitted for the carrying of frozen and chilled meats plies between the Rio Plata and European ports, with lesser facilities for meeting the requirements, just beginning, of North America. It is estimated that of the British investments of approximately $2,500,000,000, more than one-half is devoted in one way or another to the cattle or packing industries. Likewise, Argentina has been a favorite field for American investments, particularly in extensive packing establishments. Due to the European War demands they have been operated at their capacity. Southern Patagonia, formerly considered a bleak, waste territory, has become an important producer of meat, principally mutton, the packing-houses for which are located at Punta Arenas, Chile.

The exports of «pastoral products,» comprising frozen and chilled beef, frozen mutton, sundry frozen meats, preserved meats, extract of beef, powder of meat, preserved tongues, livestock — cattle and sheep — condensed soup, and jerked beef — «tasajo,» according to the figures of the Dirección General de Comercio y Industria, at five-year periods from 1885 to 1913, are as follows: 1885, $6,684,945; 1890, $9,971,249; 1895, $14,768,972; 1900, $13,894,206; 1905, $33,170,104; 1910, $43,440,235; 1911, $53,167,086; 1912, $56,502,816; and 1913, $53,486,761. Under the general heading «pastoral products,» the United States consul at Buenos Aires states the exports for 1914 as $146,389,581; for 1915, $211,057,640. These last two years doubtless include hides, an important item of exports, the total of cattle hides, in pounds, for the year 1914 being 122,552,518 (of which 102,541,570 to the United States); and 1915, 182,848,061 (of which 142,564,077 to the United States). Of the beef exported, the United States bought, in pounds, in 1914, 115,784,599; United Kingdom, 604,866,777; 1915, United States, 84,077,633; United Kingdom, 637,903,108; the other large purchaser being France, 1915, 46,626,817 pounds.

Bolivia.— Bolivia is concerned chiefly with the mining and rubber industries. While stock raising might be successfully carried on in many portions of the country, it has, despite the encouragement of the government, been neglected except for local needs. While there are sufficient cattle for domestic purposes, and many thousands running wild, the export of meat will probably be delayed many years, as the grazing lands are located far in the interior of the continent and the means of transportation to the sea coast are difficult and costly. In that part of the Andes occupied by Bolivia and Peru are found the llama, alpaca, vicuña and the domestic sheep, all producing meat for local demands, besides a very fine quality of wool for export. In 1913, 465 metric tons (2,205 pounds) of cattle hides were exported; in 1914, 374; and in 1915, 613. In addition, 6,558 head of cattle on hoof were exported to Brazil and Argentina. In view of this threatened depletion of the herds, the government is at present considering the prohibition of shipments of livestock, at the same time having already authorized the free importation of cattle, with a view of introducing the better breeds.

Brazil.— Brazil has devoted her greatest attention to the coffee and rubber industries, her exports in 1915 of these products being respectively 60 per cent and 13⅓ per cent of all products sent abroad. (See articles COFFEE; RUBBER). The attention paid to this source of wealth has, consequently, resulted in the neglect of other industries, except such as have been required for home needs. Stock raising has only recently been attempted with a view to export. It is true that Brazil has long been a great source of cattle hides, but their number has been measured by the domestic consumption of meats. It is since the outbreak of the European War that serious attention has been paid to a diversification of industries, particularly meat. The increasing home demand for coffee, due to the increase of population — threatening a curtailment of exports — and the competition of cultivated Oriental rubber plantations, has aroused the government officials and economists, and late in 1916 the preliminary session of the Sociedade Nacional de Agricultura (National Agricultural Society) was held at Rio de Janeiro, called for the purpose of studying the Brazilian livestock situation, particularly as regards cattle. Among other phases considered were: domestic breeds, their degeneration and means for their improvement; relative productive capacity; world supply and demand; possible federal, state and municipal assistance. Plans were formulated for special courses in all subjects related to the cattle and meat industries, and the formation of an efficient corps of veterinarians and bacteriological experts to uniformly control cattle rearing and meat sanitation, with the establishment of zootechnic stations and model farms. In addition consideration was given in detail to the transportation of stock, packing and refrigeration, domestic and oversea freights and the question of direct government supervision over same. As a result of this meeting, a cattle exposition was held at Rio de Janeiro, 13–28 May 1917, cash prizes and diplomas being provided by the society, and Chicago packing firms contributing handsome cups.

The number of cattle in Brazil at the present time is conservatively estimated at 30,705,400 — 1,222 per capita, and 9.03 per square mile — the greater number being found in the southern and western parts of the country. Of the States, São Paulo has 1,312,000, Piauhy, 1,163,000, Ceará, 1,162,000, Rio Grande do Sul, 7,249,000, Minas Geraes, 6,861,000, Bahía, 2,683,000, Matto Grosso, 2,050,000, and Goyas, 1,873,000. In addition, the estimate of sheep is 11,000,000; goats, 10,000,000; and swine, 20,000,000. With the exception of the southern part of Paraná, frosts are unknown, and the native pasturage, known as «caipam gordura»— fattening grass — is abundant the year around. In addition, water is plentiful and shade trees, necessary in the more tropic portions, are abundant. It is generally reckoned that in the cattle states four acres of grass is required for each animal. Certain parts of the country, in the northern and eastern portions, are totally unfitted to cattle raising, and other portions are occupied with agriculture, mining and rubber, and these must be served by the meat-producing states. Besides the newly-organized Sociedade Nacional de Agricultura, many of the individual states have their local cattle fostering organizations, under whose auspices fairs and expositions are held annually. In Rio Grande do Sul a state union — the União dos Criadores — was organized in 1915 with the purpose of inducing the government to promote rural development, including improved transportation facilities, co-operation in the purchase of necessities required in the cattle industry, particularly cattle for breeding, barbed wire, salt, wind-mills, etc. In two years the Union enrolled 1,600 members, and attained a flourishing condition. From its headquarters at Porto Alegre a monthly magazine is issued, for the use of its members, the public and for exchange purposes with like organizations throughout the world. The president of the commonwealth of Minas Geraes, the fifth state in size in the country, in his last annual message (1916) called particular attention to the lack of transportation facilities, a general need throughout the republic, and proposed a concerted effort to increase the frozen meat industry in that particular state. He mentioned in particular the shipments of this product from Santos, beginning in September 1914, with 3,100 kilos, valued at $270, and increasing during the calendar year 1915 to nearly $1,500,000, and during the first four months of 1916 to $1,177,000, the bulk of this being raised in Minas Geraes. Government aid has been given in this commonwealth with good results, cattle fairs having been established at Tres Corações, Sitio, Bemfica, Lavras and Campo Bello, at which 192,336 head were sold in 1913.

The native livestock of Brazil — of Portuguese origin — is well suited to the climate and pasturage of the country, and has recently been successfully crossed with foreign breeds. While small, the domestic animal, known as the «gado criouli» (creole), is not unsuited to beef purposes, and by selective breeding has attained an excellence that fits it for exhibition purposes in competition with foreign breeds, or with the «mestico,» the native crossed with imported sire. Of the domestic strain, the most desirable are of the four types known as «caracu,» «curraleiro,» «cortaleiro» and «mocha.» Of the foreign breeds introduced, the Polled Angus is considered the best, the Hereford and Shorthorn being second and third choice. Some attempt has been made to cross the zebu, from India, with domestic stock, as being adapted in certain parts of the country to withstand the intense tropic heat and insect pests.

As regards meat production, Brazil has long supplied her domestic needs, in addition to exporting quantities of dried beef, known as «xarque,» «charquai,» «tasajo» and «biltong.» In the city of Rio de Janeiro alone 31,150,020 pounds were consumed in 1916, and 9,912,056 pounds re-exported, principally to the Amazon ports. Of these amounts, the states of Rio Grande do Sul supplied 2,843,302 pounds, Matto Grosso, 5,044,930, and Minas Geraes and São Paulo, 22,806,366 pounds, figures that indicate the extent of local production. The dried beef industry continues as an important branch of Brazilian commerce as well as that of other South American states — the product is cheap, wholesome, may be produced without expensive equipment, requiring no coal or ice, both extremely expensive, and is easily transported. However, coincident with the European embroglio, the country awoke to the fact that a handsome profit was in store for foodstuffs, particularly meat, with the warring nations, and during the period following 1914 rapid strides were made in the installation of frozen and chilled beef packing plants.

The exportation of refrigerated meat, in consideration of the short time that it has been a subject of Brazilian trade, has been important. The first shipment was made from Santos, consigned to New York, in July 1915, amounting to 205,350 pounds, the whole amount exported from that port during the same year amounting to 17,482,839 pounds; from Rio de Janeiro, 1,239,992 pounds; and from Para, 7,902 pounds, a total for the six months of 18,730,733 pounds, valued at $1,530,399. Of this quantity, the United States received 4,393,287 pounds; France, 222,910 pounds; United Kingdom, 9,592,626 pounds; and Italy, 4,521,910 pounds. During the first 11 months of 1915, 14,686,386 pounds were exported, and in a like period of 1916 the number was 70,268,566 pounds, an increase of approximately 400 per cent, a ratio that is maintained in the shipments during the early months of 1917, with Rio de Janeiro, however, leading Santos in the quantity shipped.

Shipping facilities had to be created to handle the export meat trade, the regular steamship lines calling at Brazilian ports adapting themselves to the new requirements. The steamship *Rio de Janeiro* of the Lloyd-Brasileiro Line — owned by the Brazilian government — made its first trip with refrigerating installation leaving Santos for New York 4 July 1915, with 205,350 pounds of beef. Other boats of the same line, the *Minas Geraes*, the *Acré* and the *São Paulo,* have since been fitted with cold storage holds for the same trade. In addition, the English and French lines making Brazil have every facility for handling meats. On 15 Sept. 1916, the *Highland Harris* (English) carried a cargo of 6,398,000 pounds from the packing-house at Vera Cruz (Rio de Janeiro); and on 19 Nov. 1916, the *Cravonshire* (English) carried 8,132,500 pounds, in addition to 1,100 cases of canned meats from the packing plants at Barretos and Osasco. Thus far, the greater quantity of refrigerated meats has gone to Europe. While a large quantity has been cleared for the United States, the Summary of Commerce makes no mention of imports from Brazil, the quantity shipped here doubtless having been transshipped.

On the by-products of the meat industry, hides have been the most important. In 1913, the total exports were 35,075 metric tons (2,204.6 pounds), of which the United States received 1,122, Germany, 9,823, France, 9,892 and Great Britain, 1,585; for 1914, the total was 31,434 metric tons, of which the United States received 5,617, Germany, 8,964, France 5,432 and Great Britain, 1,845; for 1915, the total was 37,080 metric tons, of which the United States received 19,796, Germany, none, France, 2,701 and Great Britain, 3,386 — the exports of the United States approximating 54 per cent of the total. In addition, the exports of sheep and goat skins for the years 1913–14–15 amounted to 3,232, 2,487 and 4,573 metric tons respectively, the United States buying from 75 per cent of the total in 1913 to 98 per cent in 1915.

Chile.— Chile, with her mineral and chemical industries and shortage of grazing lands, has been unable to produce sufficient beef for her own consumption. In 1914, animal products to the amount of $4,500,000 were imported. The number of horned cattle in the country in 1915, according to the official estimate, was 2,083,997. Besides, there are about 4,600,000 sheep and 221,000 hogs in the country. With the opening up for settlement of the six southerly states of Chile for agriculture and stock raising, there is a probability of the country excelling in the packing and export of meats, particularly mutton and sheep products. The great centre for livestock production extends southward from Llanquihue to Cape Horn, the commercial centre being Punta Arenas, on the continent side of the Strait of Magellan. A city of 17,000 inhabitants, it has grown up during the past decade as the packing centre of Chile and Argentine Patagonia. In 1914, the shipment of animal products, chiefly to Europe, amounted to $5,405,120; in 1915, $6,853,229. Although Punta Arenas is in Chilian territory, there is no indication in the statistics of the country as to what part of these exports is to be credited to the nation, and in fact a great proportion should be credited to Argentina. The cattle and sheep and packing interests in and around the city of Punta Arenas represent a capitalization of approximately $8,000,000.

Colombia.— Columbia has thousands of acres of fine grazing lands open the year around, principally in the Magdalena and Sinu valleys, on the Pacific highlands and the Caribbean coast. The number of cattle is estimated at 5,000,000 — 1 per capita. Locally, the cattle industry is of importance for the domestic supply of meat afforded, and for the quantity of hides exported. Some few cattle are sold abroad. In 1914, 400 head of beef steers were shipped to Panama; in 1915 the number was 850, increasing in 1916 to an estimated 1,000 per month. During the same year (1915) 41,255 head of cattle were shipped to the United States, which fact vouches for their sanitary excellence, in striking contrast to former conditions that kept Colombian livestock off the United States and Cuban markets. Lately the government has taken strong measures to assist the cattle industry, one being the law of 1915 providing for the establishment of packing plants on the Atlantic Coast, the products of which may only be exported, under government inspection and supervision. In March 1917, announcement was made of the government contract with Evaristo Rivas Groot for the erection of a plant on the Gulf of Morrosquillo. The shipment of hides is an important source of income, those sent abroad in 1912 amounting to $2,661,721.50; 1913, $3,180,781.68, of which the United States received $1,024,955 (1912) and $966,759 (1913). The exports of hides to the United States in 1914 were $1,042,174; in 1915, $1,904,558; and in 1917, $1,639,167.

Costa Rica.— Costa Rica had, in 1905, 304,662 head of cattle, and 79,730 hogs; 1910, 333,417 head of cattle, and 69,712 head of hogs; and 1915, 347,475 head of cattle, and 76,198 head of hogs — .845 head of cattle per capita, and 18.54 per square mile. According to the report of the United States consul, Costa Rica offers rich possibilities for the cattle industry, there being large tracts of suitable grazing land procurable in fee at from $0.50 to $1 per acre, or on lease for about one-tenth of these sums. In addition, cattle are easily moved, no great distances having to be traveled, and the climate being favorable, no shelter is required. The most available cattle lands are situated in the provinces of Alajuela, Cartago and Guanacaste. The present stock of cattle consists of the native breeds crossed with the Holstein, Guernsey and Durham. There is no refrigerating packing-house in the country, but a considerable number of cattle on the hoof are shipped to the Canal Zone. The number of cattle slaughtered in 1905 was 34,081; 1910, 48,371; and 1915, 50,111. From these, hides were expored in 1905 to the value of $108,810; 1910, $125,419; and 1915, $160,124. Exports of cattle and calf hides to the United States amounted in 1911 to $63,853; 1912, $39,392; 1913, $49,906; 1914, $50,634; 1915, $87,749, and 1917, $308,275.

Cuba.— In Cuba, according to the registrations of the Department of Agriculture the number of cattle (1914, 3,395,000 — official) (1916) is 4,000,000 — 87 per square mile and 1.62 per capita. (*Commerce Reports,* 20. Sept. 1916, p. 1079). The republic, due to the diversity of its particular tropical productions, tobacco and sugar, and the high price of land, has not paid uniform attention to the cattle industry. At the conclusion of the War for Independence there were few cattle left on the island, and importations were made from Porto Rico, the United States, Mexico and South America in 1899 of range cattle to be fattened on the domestic pastures. At the same time, and since, breeding animals have been imported, principally from the United States, with the result that in the provinces of Camagüey, Oriente and Santa Clara many fine ranches are found. In these provinces land is reasonably cheap, grazing is good and water is plentiful. Most of the grazing land is fenced, and from two to three acres of native grass — either Guiena or Parana — is sufficient for each animal the year around, with necessity for extra feeding during the frequent droughts. The favorable natural conditions resulted in a rapid increase in the number of cattle, and in 1905 the island was considered as being overstocked, from the fact that the supply was too limited to warrant important refrigerating plants and shipping facilities for dressed meats, and, being grass fed, the cattle could not be exported on the hoof successfully. Since 1905, the number of cattle has increased with the population, while a steady improvement has been shown in their breed and weight, and a marked improvement in their sanitary condition.

Within the past 10 years cattlemen have recognized the advantage of proper facilities on their ranches, and numerous extensive improvements have been made in the matter of conveniences, such as wind mills, tanks, ponds and silos, and in some rare cases efforts have been made to utilize the by-products of the sugar industry in the fattening of cattle. Alfalfa has, likewise, been introduced, and, when the soil is inoculated with the alfalfa bacteria, it has proven of great utility in supplementing the native feedstuffs. At present there are no packing-houses in Cuba. There is, however, at Habana a refrigerating establishment of limited capacity for supplying the local hotels and steamship companies with frozen meat. Due to this fact, the general method of meat preservation is that of dried beef, large quantities of which are consumed in the republic, the domestic supply being at present insufficient.

The exports of live cattle in 1914 amounted to $14,925; 1915, $7,715; hides and skins, 1914, $2,365,498; 1915, $3,038,429; other animal products, 1914, $148,901; 1915, $76,653. With the exception of a small part, all these exports were made to the United States. During the same years there were imported, 1914, 22,808,429 pounds of salt, fresh, canned and jerked beef, valued at $2,746,485; in 1915, the amount was 15,498,600 pounds, valued at $2,137,642, nearly all (jerked beef) coming from Argentina; 1914, 6,829,067 pounds; 1915, 3,744,766 pounds; and Uruguay, 1914, 14,426,820 pounds; and 1915, 11,617,423 pounds.

Ecuador.— Ecuador is mountainous over much of its area, and is industrially concerned with the production of cocoa and other tropical products, to the neglect of the cattle industry. There is, however, much available land suited to livestock, particularly on the Esmeraldas and Santiago rivers and on the table-lands to the east of the Andes. The entire stock of cattle, nearly all of native breed, is consumed at home, the hides alone being exported. These latter amounted in 1909 to $220,600; in 1910, $257,252; in 1911, $210,428; and in 1912, $294,898. Many attempts have been made by large landholders and corporations doing business in the country to encourage the industry of cattle raising, and annual fares are held at Quito. Hides to the amount of 2,217,529 pounds.

Guatemala.— Guatemala has, according to official estimates (1915), 655,386 head of cattle — 13.57 head per square mile, and .309 per capita. The great majority are of the native strain, weighing on an average 850 pounds. Imported breeding stock has lately been introduced, among which were 400 bulls from the United States, in 1915. For crossing purposes the Hereford and Little Holstein are the favorites, the animal produced by the crossing weighing from 1,100 to 1,200 pounds.

All sections of the republic are suitable for cattle, but the favorite portion for fattening purposes is the Pacific Coast slope, where on an acre and a half of Guinea or pampas grass per animal they are prepared for market. The advantages of this particular section have attracted cattle from the other parts of Guatemala, as well as Honduras. The drive from the latter country is estimated at 40,000 head annually. Meat being abundant and cheap its consumption is very high. The late ruling price of beef cattle on hoof at the principal market, Guatemala City, is $0.04 per pound. In 1914 the prices for 122,000 head of cattle slaughtered ranged from $0.0075 to $0.03 per pound. In 1915, under a special concession, three shipments of cattle — amounting to 2,198 head — were made to the United States through the port of New Orleans. They were sold to the packing-houses at Chicago and Saint Louis for $0.065 per pound. As evidence of tick infection was found, further shipments were prohibited by the United States Bureau of Animal Industry. A recent concession for a packing plant near Quiriga, Guatemala, on which construction has commenced, promises to give an increased impetus to the cattle industry in both republics. Arrangements have been made for the shipment of the prepared beef direct to the United States. The exports of cattle and calf hides to the United States amounted in 1911 to $11,852; 1914, $6,871; 1915, $210,805; and 1916, $197,107.

Honduras.— Honduras has, according to conservative estimates, 489,000 (1914) head of cattle — 10.57 per square mile and 1.78 per capita — with a present annual increase of from 12 per cent to 15 per cent. It was recently the subject of a special investigation of the United States Department of Agriculture with regard to its livestock prospects, and a favorable report was made. The greater number of cattle is found in the departments of Olancho Choluteca, with numerous herds in the departments of Cortes, Colon, Atlantida and Yoro. Water and shade are abundant, and the Guinea and Para grass is at times so rank that it hides the cattle that graze in it. Formerly many cattle were shipped annually to Cuba, and at present large numbers are being sent to Guatemala, Salvador and British Honduras. A beef-packing plant near the town of Quiriga, Guatemala, on the Honduras side of the boundary, has a capacity of 50 head per day. The concession controls 100,000 acres of land in Honduras alone, well stocked. The exports of hides to the United States in 1911 amounted to $35,563; 1914, $82,332; 1915, $137,773; 1916, $325,460 and 1917 to $291,472.

Mexico.— Due to the recent disturbances in Mexico, it is difficult to estimate the extent of the cattle industry to-day. In 1902 the number of cattle was reckoned at 5,142,457 head, a low estimate. At present, the supply of cattle for the meat demands of the country is inadequate, so much so that in October 1916 a partial embargo was placed upon their export, which embargo was in May 1917 made complete. The statement of Consul Philip C. Hanna at Monterey, made to Washington (Consular Reports, 9 Aug. 1916), is generally true for the whole republic: «Large areas . . . over which large herds of cattle roamed, are to-day empty pastures. A large sum in export duties was collected, but the meat supply . . . has been greatly reduced. . . . The declared export value of hides and bones from this consular district for the year, as compared with 1914, reveals the fact that there was a falling off of 10 per cent in dry cattle hides, 72 per cent in green (or butcher) cattle hides, 54 per cent in goat skins, 80 per cent in pig skins, and 36 per cent in crude bones. One of the many serious problems confronting the nation at present is the replenishing of its meat supply and at prices within the purchasing power of the poor.» Supplementing this, Consul Frederick Simpich, of Nogales, reported (1916): «Heavy exports of cattle have greatly depleted the herds, but owners were compelled to sell, in many cases, in order to protect themselves. The wholesale stripping of the ranches, wherein cows, heifers, and all were sold, has discounted the future for several seasons ahead.» In 1915, the exports from Mexico of cattle amounted to 13,907 head, valued at $332,699; 1916, 24,919 head, valued at $556,540. Of cattle and calf hides exported to the United States the number of pounds was: 1911, 22,871,509, valued at $2,796,652; 1912, 28,264,745, valued at $3,583,851; 1913, 29,559,779, valued at $4,230,382; 1914, 37,750,732, valued at $6,367,721; 1915, 50,808,523, valued at $8,357,078; and 1916, 44,101,773, valued at $7,661,104. The exports of fresh beef and veal to the United States in 1914 amounted to 212,865 pounds, valued at $14,114; 1915, 3,941,131 pounds, valued at $384,497; and 1916, 1,316,698 pounds, valued at $127,800.

Nicaragua.— Nicaragua has about 500,000 (estimated) head of cattle — 10.1 per square mile, and .833 per capita. Cattle raising has been up to the present one of the greatest industries in the republic, there being produced sufficient for domestic demands and a surplus available for shipment to Costa Rica, Salvador, Honduras and Nicaragua. The number exported annually is on an average 50,000 head. The departments of Chonales, Leon and Segovia in the western part of the country are admirably adapted to the industry, and recently (1916) the United States consul at Bluefields in a report to Washington recommended very highly the territory in his district for cattle raising, mentioning it as the only industry within the country wherein the producer was independent of the middleman, the demand for beef being so great that buyers were constantly scouring the country for livestock. The principal cattle market is Tipitapa, department of Managua. Good grazing land is obtainable at from $0.75 to $1 per acre. The exports of cattle and calf hides to the United States in 1911 amounted to $142,589; 1912, $124,403; 1913, $205,817; 1914, $173,281; 1915, $358,642; and 1916, $454,648 and 1917, $460,738.

Panama.— Panama has, according to the *Bulletin* of the Pan-American Union, 166,937 head of cattle — 5.15 per square mile, and .49 per capita — with estimated facilities for caring for 5,000,000. One-third of the cattle in the country are in the province of Chiriqui, the other cattle-producing provinces being Cocle, Veraguas, Los Santos and Panama. The exports of hides to the United States in 1911 amounted to $102,502; 1912, $112,480; 1913, $118,380; 1914, $172,443; 1915, $264,244; 1916, $301,633 and 1917, $332,512.

Paraguay.— Paraguay ranks her cattle industry as her chief resource. In 1877 there were 200,525 head of cattle in the republic; in 1886, 729,796; in 1899, 2,283,039; in 1902, 2,460,969; and in 1915, 5,249,043, the rapid increase being due to the lack of market, in addition to the large number brought in from Argentina and Brazil to occupy the cheap grazing lands. The natural increase, above those slaughtered, is reckoned at 6 per cent annually. The number per capita is 5.249, second only to Uruguay with 6.518 per capita, and 8.8 times that of the United States with .59 per capita. Due to its importance as a national asset, the government has been very liberal in the matter of granting concessions for stock raising and in the elaboration of meat and its allied industries. As a result, at the present time most of the available grazing land is taken up by settlers or large cattle companies, even in the Chaco, the extensive prairie territory lying west of the Paraguay River. The existence of cheap land has attracted many stockmen from Argentina, excellent pasturage being purchasable at from less than $1 up to $4 per acre. Land values are reckoned according to their access to transportation, rather than according to their availability for stock raising. A thoroughly regulated Department of Animal Industry is maintained by the government, and sanitary regulations are enforced against the introduction or spread of the foot-and-mouth disease or other plagues. The experts and veterinarians in charge are chiefly men that have been educated at government expense in the technical schools of the United States and Europe. In addition, the Sociedad Ganadera del Paraguay (Live Stock Association of Paraguay), an organization of stockmen and business men, under the patronage of the banks of the country, has been an important factor.

The native, or «criollo» (creole), breed is a small animal, weighing from 850 to 1,000 pounds, incapable of putting on much fat. When crossed with European stock it is known as «mestico,» and compares favorably with ordinary unpedigreed stock, and thrives and fattens on the luxuriant pasturage afforded the year around. Efforts have been successfully made to cross the «criollo» with Zebu stock from India, and in addition at the present time many bulls of the Shorthorn, Hereford, Holstein and Polled Angus breeds are being introduced. Of all the stock in the country, it is estimated that 80 per cent is native and 20 per cent mixed with European breeds.

The abundance of pasturage, supporting from 25 to 40 animals per 100 acres, with fattening herbs indigenous to the upkeep of a cattle ranch very low as compared with neighboring countries, and with the introduction of more adequate transportation facilities, along with refrigerating plants, Paraguay promises to be the great livestock region of South America. At present no fresh meat is exported. In dried beef, or «tasajo,» however, the trade has always been considerable, the amount exported in 1913 being 3,771,625 pounds; 1914, 1,638,232 pounds; and 1915, 2,363,905 pounds. The first shipment of this product made to the United States — 4,500 pounds — was made in April 1917. It is expected that within a year regular shipments of refrigerated beef will be made, one packing plant, or «frigorifico,» at Trinidad being just completed, and the materials for the erection of another at Asunción being now on the ground. In 1917, 241,344 hides were exported.

An increasing number of fat steers is exported annually, most of them being purchased by the Buenos Aires packers. The number for 1910 was 11; 1911, 137; 1912, 4,661; 1913, 36,564; 1914, 24,385; and 1915, 29,509. During the same period the number of cattle slaughtered for local consumption, representing also the number of hides produced — of which 90 per cent were exported — was: 1910, 343,447; 1911, 302,375; 1912, 238,042; 1913, 362,484; 1914, 318,397; and 1915, 340,692. The market price for steers for local slaughter during 1915 averaged $20 per head; for export, $25; and cows, $14.

Peru.— Peru is not a cattle country, other than for local needs. The mountainous nature of the country and the profits arising from certain minerals and special products of the country have relegated the livestock industry to a minor position. The llama, alpaca and vicuña, all native to the region, furnish wool and meat in small quantities, domestic sheep raising being in addition an industry of some importance. As concerns beef and cattle products, a considerable quantity is imported, the figures for 1912 being $206,706; for 1913, $118,864; and for 1915, $113,193. In addition, in 1913, there were imported from Chile cattle to the value of $46,834, and from the United States $7,991, the former being chiefly for slaughter, and the latter for breeding. Of exports, live cattle valued at $9,811 were sold in 1912, the amount in 1913 being $177,832. Hides of all kinds of livestock exported in 1912 amounted to $617,410; in 1913, $930,629. Of this last, cattle hides comprised $641,624, the same item amounting in 1914 to $521,947.

Salvador.— Salvador is essentially an agricultural country, coffee, sugar and rice being the great staples. The result is that the cattle industry, other than for dairying and domestic consumption, has been neglected, despite the efforts of the government to foster it. The number of cattle in 1906 was 284,000, later estimates indicating a small increase. So small is it in comparison with the size of the country and the population that during the year 1914 the total exports of hides amounted, according to the figures of the Salvador government, to only $48,669, of which $31,313 went to Germany, and $14,906 to the United States. Evidently on a different basis of valuation, the United States figures regarding imports of hides from Salvador are as follows: 1911, $32,248; 1912, $45,393; 1913, $69,960; 1914, $78,650; 1915, $135,799; and 1916, $149,577.

Uruguay.— Uruguay partakes of the advantages afforded to the cattle industry by its geographical location, being of that group comprising southwestern Brazil, Argentina and Paraguay, the natural pasture of livestock. The number of cattle in the country (1916) was 8,192,602 — 6.518 per capita, the highest in South America, and approximately 17 head per square mile. This branch of industry has been the main resource of the country, formerly in the shipment of cattle on the hoof, the export of dried beef, or «tasajo,» hides, beef extracts, and in addition, its sheep products, its sale of wool alone for 1909 being $18,682,112; 1910, $15,036,977; 1911, $19,491,761; and the first six months of 1913, $18,740,037. Meat and meat extracts (including mutton) were exported in 1909 to the amount of $6,190,979; 1910, $7,571,611; 1911, $7,017,944; and in the first six months of 1913, $1,083,900; during this last period slaughter-house products and frozen and chilled beef were classified separately, the former amounting to $8,404,900, and the latter to $3,868,995, a total of $13,358, 795 for the half year, the quantity exported since that time being greater per annum, as is indicated by the imports into the United States of fresh beef and veal — 1914, 38,712,846 pounds, valued at $3,313,618; 1915, 13,802,565 pounds, valued at $1,175,293; and 1916, 116,549 pounds, valued at $10,486. The sharp decrease for 1916 is explained by the great European demand, a demand that also called for the re-export of 18,000,000 pounds of the quantity imported in 1914. Animal products exported in 1917 were valued at $93,456,574.

Realizing the importance of the meat industry, the government of Uruguay has devoted the greatest attention to measures for its encouragement, promoting exhibitions of livestock and establishing experiment stations, decreeing sanitary regulations with regard to the cattle plague, quarantines, abattoirs, certification of meat, etc. In October 1916, the President recommended to the General Assembly the creation of a Department of Live Stock to operate under the Ministry of Industries, at the same time outlining the need for a central organization to direct the industry, to combine in one department the various offices in charge of inspection, animal diseases, marks and brands and import and export requirements.

Venezuela.— Venezuela, formerly the home of great herds, has to-day about 3,500,000 head of cattle, although estimates have given as high as 9,000,000. About 500,000 are slaughtered annually, the great majority for domestic consumption. It is estimated that there are more than 100,000 square miles available for stock raising. On 12 March 1917 a presidential decree was issued establishing an experiment station near Caracas, to take up the problems of intensifying the industries of the republic, including livestock. In the valley of the Orinoco, and particularly along the Colombian boundary in the state of Tachira, are splendid pastures, well watered and of uniform climate, where the cattle industry flourishes. The exports of hides (principally to the United States) in 1913 amounted in round numbers to $1,492,000; in 1914, $1,390,000; and the first six months of 1915, $845,000. Of cattle exported in 1913, the valuation was $625,000; in 1914, $285,000; and the first six months of 1915, $138,000. In addition, a small quantity of dried, salted and frozen meat was exported. W. B. GRAHAM,

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11. HIDES AND LEATHER IN LATIN AMERICA. During war conditions, the price of hides and leather became unprecedented. But aside from war, the natural world demand is increasing faster than the production. During the decade, 1890–99, inclusive, the average price of hemlock tanned sole leather was $0.1939 per pound. At the beginning of 1916 it sold for $0.3250, an advance of 67 per cent. Oak tanned sole leather in the same period advanced 57.6 per cent; calf-skin, 58.8 per cent, and oak tanned harness, 49.9 per cent. During 1916 and 1917 a more than appreciable advance was made, and leather manufacturers protested their inability to secure the raw stock of hides. This upward movement was reflected strongly in the great cattle states of Latin America and in some it was the temporary financial salvation during the early commercial depression following the outbreak of the European War — as being a staple of immediate and cash demand.

Despite increasing production, little attempt has been made to use hides industrially in their respective countries. The great bulk is exported in its raw state, despite the fact of the vast quantities of tanning materials available throughout Latin America — quebracho, mangrove, divi divi and innumerable others. These tanning materials are, in their turn, particularly during the past decade, an important export item, many shipments abroad being carried by the same bottoms that transport the hides for which they are intended.

As the greatest cattle country of South America, Argentina is the greatest producer of hides. Exports in 1885 amounted to $12,040,113; 1890, $10,931,216; 1885, $15,273,154; 1900, $13,436,361; 1905, $19,076,544; 1910, $30,711,408; 1911, $34,440,015; 1912, $42,129,576; 1913, $38,532,700; 1914, 124,552,518 pounds, and 1915, 182,879,061 pounds. Of this number 46.5 per cent was wet and 53.5 per cent dry. In this connection it may be stated that all packing-houses and most of the metropolitan butchers' hides are wet, while the hides of beeves killed for individual consumption are usually dry, the former commanding a uniformly higher price, as their texture is devoid of the unevenness caused by unequal drying, as is frequently the case with the dry hides, these latter also frequently showing the marks of the unpracticed skinner's knife. Exports to the United States during the fiscal year ending 30 June 1912, amounted to $15,220,904, and 1916, $32,754,929, in addition to goat, sheep and other skins. The United States is the greatest buyer.

Bolivia has many cattle, the greater number on ranches, but many running wild. The exports of hides in 1913 amounted to 465 metric tons (2,204.6 pounds), valued at $143,916; 1914, 374 metric tons, valued at $104,666, and 1915, 613 metric tons, value not stated. Only a small part was consigned to the United States.

Brazil, according to the report of the United States consul at Rio de Janeiro (*Commerce Reports*, 26 May 1917), concerning the market for shoes, states that local industry in the manufacture of this article is increasing. Other reports also indicate that leather is being prepared from domestic hides in increasing quantities, due to the availability of so many excellent tanning materials, not, however, on an export scale. Cattle hides to the amount of 35,075 metric tons (2,204.6 pounds), were exported in 1913; 1914, 31,434 metric tons, and 1915, 37,080 metric tons (see LATIN AMERICA, CATTLE AND MEAT INDUSTRY OF). During the fiscal year ending 30 June 1916 the exports of cattle hides to the United States amounted to 59,729,930 pounds, valued at $12,282,472.

Chile, in 1913, exported hides to the value of $1,537,850; 1914, $918,260, and 1915, $1,670,750; the export of leather during these last two years being $225,627 and $261,342, respectively. No exports of consequence have been made to the United States until recently, the amount in 1915 (fiscal year ending 30 June) being 802,585 pounds, valued at $122,152, and 1916, 6,887,970 pounds, valued at $1,091,343. Leather to the value of $49 was exported to the United States in 1915 (fiscal year), and $2,555 in 1916.

Ecuador exported hides in 1912 to the value of $29,839; 1913, $5,604; 1914, $120,730; 1915, $66,459; 1916, $148,864. In a statement from the United States consul at Guayaquil (*Commerce Reports*, 13 Jan. 1917), it is said that the total for the year 1916 was shipped to the United States. Evidently on a different valuation, the reports of the United States Bureau of Foreign and Domestic Commerce give the amounts purchased from Ecuador as follows: 1916, 2,059,616 pounds, valued at $409,047 and 1917, 2,217,529 pounds, valued at $613,417.

Paraguay, during its entire history, has recognized the raising of cattle for their hides as one of its most important resources, and at the present time there is a marked increase in the production and export of this staple. The number exported, in 1910, was 343,447; 1911, 302,-

375; 1912, 238,042; 1913, 362,484; 1914, 318,397, and 1915, 340,692. In 1915 the greatest number sent to any one country was 75,175 hides, to the United States, the other large purchasers being Holland, Great Britain, Argentina and Uruguay. Evidently a part was credited to some of the transshipping countries, as the statistics of the United States Department of Commerce credit Paraguay with hides as follows: 1915 (fiscal year ending 30 June), 129 pieces (8,531 pounds), valued at $933, and 1916, 141 pieces (8,632 pounds), valued at $1,733. These are the only exports to the United States noted within recent years.

Peru exported hides, in 1912, to the value of $617,410; 1913, $930,629; 1914, $641,624, and 1915, $521,947. United States government statistics specify imports of hides from Peru, in the fiscal year 1915, at 1,003,134 pounds, valued at $174,375, and 1916, 3,263,109 pounds, valued at $584,542.

Uruguay, during the year 1909, exported hides to the value of $11,165,155; 1910, $11,147,242; 1911, $9,976,291, and in 1914, 2,079,514 pounds, valued at $8,015,476. Exports to the United States during the fiscal year ending 30 June 1915 amounted to 21,875,639 pounds, valued at $4,117,359; 1916, 44,254,341 pounds, valued at $9,275,658, and 1917, 47,314,408 pounds, valued at $9,879,167.

Venezuela exported hides, in 1913, to the value of $1,492,000; 1914, $1,390,000, and the first half of 1915, $845,000. Her principal market is the United States. On an apparently different valuation, the statistics of the Department of Commerce state the imports of hides from Venezuela, during the fiscal year ending 30 June 1915, as 7,033,382 pounds, valued at $1,639,456, and 1916, 7,530,524 pounds, valued at $1,901,421.

Regarding the northern group of Latin-American states, comprising Costa Rica, Cuba, Dominican Republic, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama and Salvador, reference is made elsewhere in this work (see LATIN AMERICA, CATTLE AND MEAT INDUSTRY OF). Of exports to the United States in 1916, Central America contributed $1,523,209 worth of hides, with the greatest proportion coming from Nicaragua, Panama and Honduras. During the same year Mexico exported to the United States hides to the value of $7,661,104; and the West Indies, including foreign possessions, $3,433,804, of which Cuba contributed $2,922,298. W. B. GRAHAM,
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12. COFFEE INDUSTRY IN LATIN AMERICA. The coffee crop of the world, according to the New York Coffee Exchange, amounts to about 2,403,324,000 pounds, or 18,207,000 bags of 132 pounds each annually. The crop of 1915–16 was above the average and is estimated at 2,487,792,000 pounds, or 19,756,000 bags. Of the total world's crop marketed in 1915–16 (19,192,317 bags) the United States took 47 per cent and Europe 53 per cent. And of the total taken by the United States (9,099,276 bags) 8,973,863 bags, or 98.6 per cent, were the growth of Latin-American countries, while we received only 125,413 bags, or 1.4 per cent, from all other countries.

The following will show the amount of coffee in bags of 132 pounds imported into the United States from Latin America and all other countries during the past five years:

YEAR	Total all kinds	From Latin America	From other countries	Per cent Latin America
1915–16......	9,099,276	8,973,863	125,413	98.6
1914–15......	8,474,928	8,328,331	146,597	98.3
1913–14......	7,587,336	7,415,975	171,361	97.7
1912–13......	6,538,869	6,366,861	172,008	97.4
1911–12......	6,706,070	6,249,218	456,852	93.2

Brazil.— Coffee is by far the most important product of Brazil, and constitutes fully 60 per cent of the total value of all exports. Not only is coffee the leading product, but Brazil leads the world in the production of this staple, its average crop the past five years being 72 per cent of the world's crop for the same period.

The states producing the bulk of the coffee crop are São Paulo, Rio de Janeiro, Minas Geraes and Bahía. Of the total crop the São Paulo district produces about 80 per cent, the Rio de Janiero district 15½ per cent and the Bahía and Victoria districts 4½ per cent. Thus, in 1915 it is estimated that the crop of the São Paulo district amounted to 14,000,000 bags (132 pounds each), that of the Rio de Janeiro district to 2,750,000 bags and that of the Bahia and Victoria districts to 750,000 bags.

The largest crop ever produced in Brazil was that of 1906–07 amounting to 19,654,000 bags, or 2,594,328,000 pounds, but in later years the crops averaged much less than this, the average production for five years (1910–15) being about 13,125,000 bags, or 1,732,500,000 pounds.

The importance of the coffee crop as a source of wealth to Brazil may be illustrated by the following tabular statement showing the value of coffee exported as compared with that of other exports:

YEAR	Value of coffee exports	Value of other exports	Coffee's percentage to total
1910...........	$127,212,875	$182,793,563	41.0
1912...........	225,992,915	136,253,036	62.4
1913...........	197,936,296	115,691,782	63.1
1914...........	129,713,673	91,825,356	58.5

The following table shows the exports of coffee (in bags of 132 pounds each) from Brazil to the various countries named during the years ended 31 July 1914 and 31 July 1915. It is interesting to note changes in the markets brought about by the European War:

COUNTRY EXPORTED TO	1914 bags	1915 bags
United States....................	5,817,628	5,880,619
France....................	1,902,647	1,808,815
Sweden....................	245,851	1,346,839
Italy....................	240,844	688,252
Great Britain....................	272,493	479,701
Norway....................	36,375	306,669
Denmark....................	45,413	279,865
Argentina....................	240,932	261,457
British South Africa............	123,690	183,457
Greece....................	7,500	117,800
Spain....................	106,475	111,843
Egypt....................	51,820	85,310
Uruguay....................	35,654	52,763
Algeria....................	72,758	49,425
Chile....................	26,684	39,692
Gibraltar....................	12,200	14,100
Turkey in Asia....................	64,682	2,550
Rumania....................	11,813	2,220
Turkey in Europe....................	70,122	2,000
Russia....................	18,913	800
Germany....................	1,876,138	....
Austria....................	1,033,173	....
Belgium....................	522,195	....
All others....................	53,352	56,170
Total....................	14,533,581	13,401,515

A comparison of the exports for 1915 with those of 1914, the year immediately preceding the World War, shows a decrease of only 1,132,066 bags, or 7.7 per cent. The increase of 1,605,334 bags exported to Scandinavian countries may be accounted for by the cessation of any direct exports in 1914 to Germany and Austria. The United States continues to be the largest purchaser of Brazilian coffee, the average imports from that country in the five years, 1910–15, amounting to 5,646,000 bags, or nearly 45 per cent of the entire crop. The total value of all the coffee exported from Brazil to the United States in 1917 was $110,052,616.

Colombia.— Of all the Latin-American republics, Colombia ranks next to Brazil both in the production and exportation of coffee. Of the average value of all exports from 1911 to 1914, inclusive, amounting to $24,309,000, the average value of coffee for the same period was $12,144,000, or 50 per cent of the whole. The coffee crop of the republic averages about 126,450,000 pounds, or 958,000 bags (132 pounds each) annually. About 25,000 bags are retained for home consumption, the remainder being shipped to the United States and to European countries. The United States is Colombia's best customer for its coffee crop, its imports from that country averaging more than 70 per cent of the annual production. The imports in 1915–16 amounted to 109,363,456 pounds and in 1916–17 to 118,410,000 pounds.

The principal coffee producing districts are the department of Cundinamarca, which produces the renowned Bogotá brand; the Ocana, Cucuta and Bucaramanga districts, in the department of Santander, and in the Tolima and smaller valleys of the Cordilleras. It is estimated that there are 125,000,000 coffee plants in these districts, and as they are valued at 30 cents each, they represent an investment of $37,500,000.

Guatemala.— Coffee is the principal crop of Guatemala. The districts best suited to its culture are Antigua, Barbereno, Costa Chuva, Alta Verapaz, Costa Cuca, Costa Grande, Pochuta and Tumbador. In some of the districts coffee of very fine quality is grown at an altitude of 5,000 feet, but the yield of the trees is comparatively light. The total area under cultivation is about 98,800 acres. Germans own and control between 50 and 60 per cent of the plantations. The best coffee is grown in the department of Alta Verapaz.

The total production of coffee in Guatemala in 1913 amounted to 104,623,600 pounds, and in 1914 to 91,852,200 pounds. Prior to the World War about three-fourths of the crop was marketed in Europe, Germany taking the largest share. The following statement shows the exports to the various countries just prior to the war, 1913:

EXPORTED TO	Pounds	Bags
Germany	53,765,128	407,311
United States	21,400,385	162,124
Great Britain	10,773,165	81,615
Austria-Hungary	4,247,353	32,177
South America	1,824,060	13,819
Netherlands	412,484	3,125
France	143,723	1,089
Total	92,566,298	701,260

During the past two years special efforts have been made to create a greater demand for Guatemala coffee in the United States, which have met with marked encouragement. In 1915 the United States imported from that country 60,363,716 pounds of coffee, which was an increase of 15,758,677 pounds, or 35 per cent over the previous year, and was 66 per cent of the entire crop. It has been estimated that in 1916 the United States took from 75 to 80 per cent of the coffee produced that year.

Costa Rica.— Coffee planting has been carried on in Costa Rica for many years, and until banana culture assumed its present proportions was the leading industry. At one time as much as 45,000,000 pounds were produced, but the crops now average much less, due to the enormous crops of other Latin-American countries and the consequent fall in value. But Costa Rican coffee is still highly prized in Europe, especially in England, where, on account of its exceptional quality and flavor, it commands a good price. According to a recent official publication the total exports from all Costa Rica from August 1915 to April 1916 amounted to 37,134,182 pounds. The exports for the years 1911–12 to 1915–16, inclusive, were as follows:

YEAR	Pounds	Bags (132 lbs.)
1911–12	26,979,893	204,393
1912–13	28,702,108	217,440
1913–14	39,058,444	295,897
1914–15	26,910,407	203,867
1915–16	37,134,182	281,320

Of the amount exported in 1915–16 Great Britain took 50 per cent, the United States 42 per cent, the remainder going to France, Spain, Italy, Panama and Chile. Prior to the World War Germany, in 1913, was the second best market for Costa Rican coffee; but the United States has now taken this rank, its imports in 1915–16 having reached 13,292,365 pounds, which is 6,521,400 pounds, or 92 per cent, greater than the imports in 1914–15, and 9,269,000 pounds, or 230 per cent in excess of the imports in 1913–14. Coffee to the aggregate value of $3,779,747 was exported from Costa Rica in 1917.

Nicaragua.—The value of coffee production in Nicaragua, as compared with other products, is indicated by the export statistics for five years (1910–15), which show that of the total average value of all exports coffee represented 55 per cent. The following tabular statement gives the quantity and value of coffee exported to different countries in 1913 and 1915, and indicates the changes that resulted from the World War:

COUNTRY	Pounds	Bags (132 lbs.)	Value
France (1913)	10,293,437	77,981	$1,715,186
France (1915)	4,382,319	33,199	607,737
Germany (1913)	7,653,182	57,979	1,844,262
Germany (1915)	....	......	....
Great Britain (1913)	3,321,692	25,164	595,613
Great Britain (1915)	4,068,766	30,824	409,171
United States (1913)	3,715,012	28,144	615,644
United States (1915)	6,303,693	47,755	668,393
Italy (1913)	621,667	4,711	97,445
Italy (1915)	3,045,698	23,074	258,166
Other countries (1913)	662,028	5,015	122,845
Other countries (1915)	626,626	4,747	64,317
Total (1913)	26,267,018	198,994	$4,990,995
Total (1915)	18,427,102	139,599	2,007,784

Nicaragua's coffee trade with the United States increased immensely within the five years

(1910–15), the imports rising from 1,144,182 pounds in 1911–12 to 9,074,757 in 1915–16, or 693 per cent in the five years. The exports of coffee in 1917 reached the amount of $3,000,000.

Venezuela.— Great efforts have been made since 1910 to increase the coffee bearing area of Venezuela. The crop of 1910 amounted to about 440,920 bags. Of this about 160,000 bags were expected to be received at the ports of La Guaira, Puerto Cabello, Guantu and Sucre and the balance from Maracaibo, Vel de Coro, etc. The exports from Maracaibo in 1911 were 54,716,265 pounds, of which 37,062,068 pounds were sent to the United States. In 1912 the exports were 71,457,942 pounds, of which the United States took 50,273,888 pounds. The average exports for the preceding 10 years, 1902–11, was 53,130,326 pounds. The imports of coffee from Venezuela from 1911–12 into the United States were as follows, in bags of 132 pounds each: 1911–12, 356,890; 1912–13, 376,296; 1913–14, 378,435; 1914–15, 548,963; 1915–16, 556,101 bags, the increase in the five years amounting to 199,211 bags, or nearly 56 per cent.

Ecuador.— While the quantity of coffee produced in Ecuador does not compare with that of most other South American countries, it is still one of the most valuable agricultural products of the republic. Considerably more than half of the crop is sent to Chile. The following shows the distribution of the crop to various countries in 1914 and 1915:

COUNTRY	1914	1915
Chile	2,768,317 lbs.	2,528,834 lbs.
France	1,323,725 lbs.	599,938 lbs.
United States	808,815 lbs.	175,143 lbs.
Spain	767,298 lbs.	558,956 lbs.
Great Britain	466,979 lbs.	....
Panama	193,536 lbs.	478,077 lbs.
Germany	146,260 lbs.	....
Italy	....	287,833 lbs.
Peru	....	16,437 lbs.
Total	6,474,930 lbs.	4,645,218 lbs.

Mexico.— The coffee crop of Mexico, which may be produced in the highland regions throughout the republic, varies from 77,000,000 to 110,000,000 pounds annually, about 40,000,000 pounds, or 43 per cent, being exported, and the remainder held for home consumption. Of course the amount of the latter is largely controlled by the market price of the product, Mexican coffee of the best brands being highly esteemed. The imports of coffee from Mexico into the United States from 1911–12 were as follows in bags of 132 pounds each: 1911–12, 258,758; 1912–13, 197,890; 1913–14, 374,133; 1914–15, 399,289; 1915–16, 377,521 bags. This shows an increase in the five-year period of 118,763 bags, or about 46 per cent.

Salvador.— The coffee crop of Salvador, as represented by its exports, in 1910–11 amounted to 74,000,000 pounds, of which 64,000,000 were exported and 10,000,000 retained for home consumption. The crop of 1911–12 is estimated at approximately 70,000,000, of which 60,000,000 were exported and 10,000,000 held for home consumption. According to government statistics the average exportation of coffee for the past 10 years is 60,553,377 pounds, and the average production 70,533,377 pounds, or 534,344 bags of 132 pounds each. The imports of coffee into the United States from Salvador since 1911 in bags of 132 pounds are as follows: 1911–12, 86,466; 1912–13, 66,335; 1913–14, 66,353; 1914–15, 119,874; 1915–16, 88,298.

Haiti.— The coffee industry of Haiti was seriously affected by the continuous political upheavals of recent years. In 1906 nearly 60,000,000 pounds of coffee were exported to the United States, whereas we received from that republic in 1916 only 3,320,000 pounds, and an average of only 3,585,000 pounds from 1910 to 1915.

Other Countries of Latin America.— The coffee crops of the other and lesser producing countries may be illustrated by the exports from each to the United States during the three years (1913–16) as follows (in bags of 132 pounds each):

COUNTRY	1915–16	1914–15	1913–14
Dominican Republic	26,785	27,048	8,130
Panama	4,959	7,659	2,337
Honduras	3,974	5,045	5,037
Cuba	82	2,151	108
Chile	190	1,921	1
Peru	2	537	1
Argentina	111	......	650

MARRION WILCOX.

13. FRUIT TRADE OF LATIN AMERICA. The most impressive fact in the history of the cultivation of valuable fruits in the Latin American tropics is not that so much has been accomplished but that so much still remains to be achieved. The past success amply justifies a confident outlook for the future in this great industry. The true proportions of the opportunity presented are brought out more clearly by reversing the ordinary arrangement of statistics, and beginning with the smaller items. Thus, a study of imports into the United States during the fiscal year ending 30 June 1916 shows:

Value of oranges imported from Costa Rica $4,343; from Honduras $1,495; from Panama $914; from Jamaica $43,843; from Cuba $9,826. Value of lemons imported from Mexico $239; from Cuba $1,800; from Brazil $33. Value of pineapples imported from Cuba $960,832; and of preserved pineapples from Cuba $35,867; from Haiti $300; from Guatemala $1,901. Value of all other fruits (with the exception of bananas) imported from tropical or subtropical America: Costa Rica $810, dutiable; Guatemala $240, free; Honduras $5,142, free, and $48, dutiable; Mexico $3,113, free, and $16,532, dutiable; Jamaica $1,301, free, and $29,272, dutiable; Cuba $63,614, free, and $404,701, dutiable; Dominican Republic $127, free; Haiti, $644, free, and $280, dutiable; Brazil $272, dutiable; Colombia $4,122, free; Venezuela $75, free.

The quantities and values of the bananas imported during the same period of 12 months into the United States from the new world's tropics were given as follows by the Department of Commerce of the government of the United States: From Costa Rica 4,058,000 bunches, valued at $2,268,844; from Guatemala 3,811,750 bunches, valued at $958,189: from Honduras 9,702,791 bunches, valued at $1,964,822; from Nicaragua 1,548,500 bunches, valued at $250,883; from Panama 4,516,307 bunches, valued at $2,113,855; from Mexico 1,527,025 bunches, valued at $424,631; from Jamaica 4,926,944 bunches, valued at $1,445,392; from Cuba 2,859,021 bunches, valued at $1,072,035; from the Dominican Republic 289,091 bunches, valued at $140,264; from Colombia 2,710,047 bunches, valued at $1,264,992. And in the short month of February 1917, imports of bananas into the United States were: 1,527,620 bunches, valued at $519,489, from the Central American states and British Honduras; 48,017 bunches, valued at $18,026, from Cuba; and from South America 226,000 bunches, valued at $113,000.

In Porto Rico (which we include in the present survey, although that island can no longer be called strictly «Latin American») the successful cultivation of grapefruit, oranges and pineapples attracts attention. In the year 1916 shipments from Porto Rico to the United States included 296,613 boxes of grapefruit, valued at $836,932, and 404,367 boxes of oranges, valued at $790,667; pineapples valued at $1,176,319 and canned pineapples $122,858, etc. Porto Rico's experience demonstrates the possibility of expanding the fruit industry by diversifying the products; there is no practical limit to the varieties of valuable fruits that the Latin American tropics can produce; and «In the Caribbean fruit trade the United States' market is, with a trifling exception, the only profitable one.» (Consult Jones, C. L., 'Caribbean Interests of the United States,' New York 1916.)

The records of achievement recorded in the first paragraph as «justifying a confident outlook» relate principally to a single species, the *Musa sapientium* or banana the fruit of which was not produced on a large scale in the Latin American tropics until citizens of the United States had established the banana trade, in 1866,— at first importing from Colón only — and then had developed the industry during years and decades of unremitting effort. Many groups of citizens of the same country have been actively engaged in this work of development and share the credit accorded to all for the successful application of northern initiative, enterprise and capital to the problems of tropical agriculture. It is especially important to remember and register the circumstance that such efforts have been in a wide sense constructive or well nigh creative; that northern commercial methods have supplied new transportation and communication facilities, and (taking in their stride obstacles that for centuries had been regarded as insurmountable) have expelled tropical fevers from their strongholds. As Mr. F. U. Adams writes in his 'Conquest of the Tropics' (New York 1914): «In 1871 there was not a mile of railroad in all of Central America [the Republics of Guatemala, Salvador, Honduras, Nicaragua and Costa Rica] with the exception of a short line having its terminal at Puerto Cortez, Honduras. There were no dependable foot or wagon roads from its capitals. . . . There was no steamship service from the United States or from any part of the world. . . . There probably was no inhabited spot on earth more isolated. These republics were cut off not only by the sea but also by barriers of pestilential lands, which the natives dreaded to cross and which the outside world could not enter. To-day these former wildernesses constitute one of the most productive agricultural sections of the globe. To-day the ships from all the world enter the beautiful harbors of Central America and land their passengers in ports which are as sanitary as those of Massachusetts. To-day most republics of Central America are served with well-managed and modernly equipped railway lines. . . . Who performed these miracles?» His answer is that they were wrought by citizens of the United States «who had the imagination, the courage and the ability to attack and conquer» the problems of tropical wildernesses; and he adds that when actual results had demonstrated to the world that the industrial and commercial conquest of the tropics was possible, this should have proved to the United States that it was the bounden duty of its people, its press and its government to encourage and foster the speedy development of those regions, not for the mere purpose of obtaining money rewards, but with the larger, broader and truly statesmanlike object of «obtaining from the tropics such of its other products as would add to the happiness and raise the standard of living of the people of the United States.» And in other passages of the same book the benefits accruing to the citizens of the Latin American republics are discussed with equal interest. Under the command of a single northern company 60,000 trained men are working in the Latin American tropics at the present time. Tens of millions of dollars have been advanced to those who otherwise would not have been able to use their lands for banana cultivation — such loans having been made, at reasonable or relatively low rates of interest — much lower than the prevailing rates for similar advances in the same localities — to residents in or citizens of Costa Rica, Panama, Colombia, Guatemala and other Caribbean regions that have become important sources of fruit supply. The problems of tropical sanitation have been attacked and mastered — not less vigorously attacked and not less thoroughly mastered on the extensive banana plantations than in the Canal Zone, Panama, or in Havana and Santiago de Cuba.

The last-mentioned achievement — the mastery of problems of tropical sanitation for the safeguarding of the health of all who labor on the fruit plantations — deserves our special consideration at this moment. The head of the Tulane School of Tropical Medicine of New Orleans observes: «The vast improvements there [in the Latin American tropics] do the genius of American medical men a credit that only future ages will appreciate. Every one knows what great sanitary work the American Government has accomplished in the Canal Zone, but few realize that a similar improvement has been worked in the rich fruit centres.» The facts adduced in support or confirmation of this statement are substantially the following: In 1900, about three years before the United States took over the Panama Canal and began the work of sanitation in the Canal Zone, more than 15,000 men were at work for a fruit company on Caribbean tracts of coastal lands which had been regarded always with fear and aversion, as though they had been necessarily and permanently disease-breeding areas. But the rate of mortality among laborers and officials was not high, for the simple reason that the basic principles of that system which afterward made possible the completion of the Panama Canal (q.v.) without terrible sacrifices of human life had already been studied, tested, accepted, and the appropriate remedies had been already applied. «In the selection of sites for new towns and settlements careful attention was given to the requirements of drainage. All adjacent swamps were cleared, and the grass and underbrush kept cut about the houses. The laborers were verbally instructed how to take precautions against the known dangers of these districts, and the medical employees of the company made regular inspections of their places of living,» to enforce compliance with such instructions. «Hospitals were erected and prompt measures taken to isolate any victim of contagious diseases.» With the co-operation of the various governments, strict quarantine was enforced against certain foreign ports whenever such action became advisable. The medical officers of the banana companies very promptly turned to good account the discovery (confirmed practically in 1898) of the causes of yellow fever and malarial fevers, and employed the most effective methods for the extermination of the disease-bearing insects; indeed, there seems to be no good reason for withholding endorsement of the assertion that sanitary work and experiments conducted by the pioneer banana companies in Costa Rica and elsewhere in the years between 1873 and 1899 were of value to those medical scientists who finally were «able to announce to the world that the mysteries of yellow fever and malaria had been solved.» After 1899 all houses occupied by employees not immune to such fevers were screened — sometimes doubly screened — to exclude pernicious mosquitoes. Petroleum was used freely in stagnant pools and slow-running streams. All expedients for eliminating the tropical menaces to health were tested and, if approved, installed on a liberal scale. For example, we may mention the adoption of the following sanitary measures at Puerto Barrios, Guatemala: All low-lying places near that town were filled in or flushed with salt water and danger-spots above high tide were drained. The camps out on the neighboring plantations were located on high, well-drained ground, and all grass and other vegetation kept low for 150 yards around these camps; tanks holding the water supply were thoroughly screened; all surface water was oiled at stated periods. The results are satisfactory; for no case of any quarantinable disease has appeared during several recent years at this port or at others to which similar preventive measures and methods have been applied.

The banana lands owned by a single northern company are 150,000 acres in extent, and those owned by its competitors and by independent growers who sell to the various importing houses, about 370,000 acres. Even now, the total area devoted to this agricultural industry approximates 520,000 acres. We have mentioned already the development of railroad transportation facilities in the Central American republics that stood most in need of them. Not less noteworthy is another outgrowth of this international dealing in the fruits of the Latin American tropics — the establishment of new steamship transportation facilities. One of the fruit companies operates 90 vessels (248,607 tons in all), with accommodations for 3,000 passengers and carrying about 360,000 tons annually of general freight for the public — thus opening not only new markets to manufacturers in the United States but also opening the markets and the opportunities of the great world to the people of Central America who had been shut off from both during long and sometimes depressing, though never, to the people there who inherit traits of the Indomitable Iberian, wholly discouraging ages.— Professor C. L. Jones, of the University of Wisconsin, writes: «One company chiefly engaged in the exploitation of the banana trade claims, with its allied interests, to have expended $200,000,000 in the [Latin] American tropics. It reports its resources devoted to Caribbean development as $88,867,408.27.» Again, on pages 296–297 of 'Caribbean Interests of the United States,' he says that the fruit trade has undergone a development similar to that of the asphalt industry. Production to some extent may be left in the hands of small planters and a minor part of the total amount marketed is still thus grown; but the work even in this stage of the industry is more efficiently performed by aggregations of capital which can assure a steady supply and transportation facilities that can be depended upon. The small planter must ordinarily market his fruit by sending it to tidewater or to the railroad on muleback. The large company can build branch railroads at a fractional part of the cost of animal transportation; and in this manner it can exploit regions which otherwise lie too far distant to permit their profitable cultivation. If a steamship cannot berth at his dock, the small producer is at a disadvantage because he can neither buy a lighter nor build the necessary landing pier. Moreover, in many of the Caribbean banana regions the public authorities neglect to supply him with these facilities. Shipments of fruits to foreign countries, he adds, cannot take place in the ordinary cargo vessels. Specially constructed steamships with refrigerating appliances are required, to keep the fruits from ripening too rapidly. «As a result of these conditions the export of fruit in the Caribbean has come to be almost entirely controlled by a few large concerns, the pioneer companies.» Particularly interesting are the same writer's comments on Cuba and Honduras. In his opinion the fruit trade of Cuba, still in its infancy, shows promise of healthy development. Bananas for home consumption are grown over the entire island, but are exported only from the north coast at the extreme eastern end where soil and climate are especially favorable. The Cuban citrus fruit (especially grape fruit) industry is increasing in importance. His studies of Central American countries lead him to say that the prosperity of the foreign trade of Honduras «depends, even more than in Costa Rica, upon the banana industry. . . . In the production of fruit the country has great possibilities. As yet, this development is confined chiefly to the north-east coast, near the ports of Tela, Ceiba and Trujillo.» The heterogeneous population of the Trujillo region is almost entirely dependent upon the banana trade, which in Honduras has apparently unlimited possibilities of development.

MARRION WILCOX.

14. RICE PRODUCTION IN LATIN AMERICA.

The use of rice as an article of food is more uniformly widespread in Latin America than in the United States. It is the mainstay of the laboring classes, and, by itself or incorporated with other foods, is found, as well, on the tables of the wealthy. From the universal demand for this cereal, it is found to a greater or less extent in all of the Latin American states, with the greatest acreage in Brazil, where its cultivation is mentioned as early as the middle of the 15th century. From the days of its earliest production it has been a subject of government control and encouragement. At the present time it is being fostered by the Ministry of Industry and Agriculture, whose efforts are directed to an increased production to reduce the cost of living — a real service in view of the fact that the greater part of wheat and other breadstuffs is imported. Under the auspices of this ministry there was published in 1914 a comprehensive work on the subject by Dr. L. Granato, entitled 'O Arroz,' and in connection with the conclusion of arrangements for a direct shipping line between Brazil and Japan, plans were perfected for the introduction of several thousand laborers «to be employed in accordance with the regulations of the national authorities in the cultivation of rice, etc.» With experienced labor and the natural facilities offered by the Brazilian climate, lands and natural streams adaptable for irrigation uses, the future of the country as a rice producer is promising.

Brazil.— The chief rice-raising state of Brazil is São Paulo. In 1912 its crop amounted to 222,992,643 pounds, 1913, 178,013,824 pounds, and 1915, 192,000,000 pounds. Of the other states, Minas Geraes, producing about half as much as São Paulo, Rio de Janeiro, Rio Grande do Sul, Ceará, Parahyba, Santa Catharina, Maranhão, Pará and Espirito Santo follow in the order named. The total production of the whole of Brazil was estimated in 1911 at 15,823,372 bushels, a figure that is exceeded at the present time. Due to the domestic demand, only a negligible quantity of rice is exported, but a large amount is imported each year, the quantity for 1913 being 17,110,195 pounds, and for 1914, 14,377,073 pounds, of which about 70 per cent was purchased in India, the remainder coming principally from Germany, the United Kingdom and The Netherlands. Of purchases from the United States the quantity in 1912 was 191 pounds, valued at $8; 1913, 13,530 pounds, valued at $636; 1914, 190 pounds, valued at $9; 1915, 274,104 pounds, valued at $11,789; 1916, 700,574 pounds, valued at $26,904; and 1917, 126,429 pounds, valued at $4,973. Due to the high customs duties and surtax, amounting to about 3½ cents per pound, the cost of the low and medium grades of foreign rice when offered on the domestic market is too high to be able to compete with the local cereal of the same quality and the greater part of all the imports consists of the fancy high-priced grain, the favorite grades being those known as the Patna and Siam.

Argentina.— In accordance with the policy of the government in its scheme for the encouragement of national industry, to make the country self supporting, the Ministry of Agriculture of Argentina has lent its assistance to the rice-growing industry, which has long passed its experimental stage. Due to climatic fitness, the northern part of the republic has seen the greatest development. In a special report by the United States consul at Rosario (15 June 1915) to Washington, it was stated that approximately 12,000 acres were under rice cultivation at that time, a decrease from the 19,664 acres shown by the government statistics of 1908. Of this latter the number of acres devoted to rice in the various provinces and territories was divided as follows: Santa Fé, 5,421; Tucumán, 4,823; Buenos Aires, 2,469; Córdoba, 1,997; Entre Rios, 1,838; Misiones, 1,530; Salta, 598; Jujuy, 526; Pampa, 334; San Juan, 54; Corrientes, 54; La Rioja, 10 and Santiago del Estero, 10. In a supplemental report (2 June 1916), certain changes are indicated in the localities of production, Tucumán, Salta and Jujuy being mentioned as the principal producers, with cultivation on a smaller scale in San Juan, Mendoza, La Rioja, Catamarca, Corrientes, the Chaco and Misiones.

Experiments have been made with the principal varieties of Chinese, Japanese, Italian and Spanish rice, and those known as vialonne, kinskú and Valencian are mentioned as being best adapted for the localities under experiment. To place the industry upon a stable basis, experts from Japan were called to study and report upon rice-growing possibilities. The climate, soil and irrigation of the northwestern provinces of Salta, Jujuy and Santiago del Estero have been reported suitable for rice culture on a large scale, with particular recommendation for the departments of Campo Santo and Santa Ana in Salta and La Banda in Santiago del Estero. Later reports will be made regarding possibilities in Catamarca and La Rioja, where conditions are already known to be favorable.

The national production of rice doubled after the breaking out of the European War, due to the general increase in the prices of cereals of all kinds resulting from the general world demand, and, particularly as concerns Argentina, the excessive oversea freight rates on imports. In the three provinces alone of Tucumán, Salta and Jujuy, the acreage devoted to rice growing in 1916 was five times that of 1915, and with the exception of certain localities — notably Corrientes — where drought was experienced, the yield per acre was the maximum. As indicating the increase, the province of Tucumán may be taken as an example, the yield being, in 1913, 4,190,000 pounds; 1914, 7,120,000 pounds; 1915, 15,430,000 pounds; and in 1916, between 15,000,000 and 16,000,000 pounds (estimated).

On the occasion of a competitive exhibition of native rice (1917) held at Buenos Aires, under the auspices of the Argentine Rural Society, it was pointed out that with an acreage of from 60,000 to 75,000 acres devoted to this cereal, the country would no longer be dependent on imports. The amount bought abroad amounted, in 1913, to 97,721,190 pounds; 1914, 123,417,935 pounds, of which the greater part came from Italy and the British possessions. The United States (supplying none in 1911 and 1912) sold Argentine, in 1913 (fiscal year ending 30 June), 7,619,152 pounds; 1914, 3,000 pounds; 1915, 3,923,611 pounds; 1916, 3,442,042 pounds; and 1917, 36,887,737 pounds.

In accordance with the policy of encouragement given to the industry, the National and Provincial governments have perfected agreements, the former through the Banco de la Nación, providing for the milling and grading of rice at actual cost to the grower. In addition, plans have been made for giving expert instruction as to its culture; for furnishing suitable seed and other inducements; and seasonable markets.

Peru.— Peru is one of the Latin American countries whose production of rice corresponds closely to domestic requirements. In mention of the industry (*Bulletin of the Pan American Union*, February 1917), rice culture is stated as having been a national industry for several centuries, the importance of which has only recently come to be realized. In the same article the annual production is estimated for the past several years as being from 70,000,000 to 100,000,000 pounds. While obsolete methods of growing and handling the cereal are still in vogue in parts of the country, there has been a noticeable advance generally in the utilization of modern appliances, due to the encouragement of the government through the Ministry of Public Industry. Rice mills are being installed, for which there is a growing demand for equipment from the United States (*Commerce Reports*, 3 Feb. 1916).

The quality of the Peruvian rice is stated by the United States consul at Lima (*Report* of 10 June 1916) as being superior and better than that imported from China, a fact that accounts for both imports and exports appearing in the annual trade reports of the country, as the former are intended to supply the cheaper grades of consumption, releasing for foreign demand the higher priced domestic product. Recently, however, in order to conserve domestic foodstuffs, an embargo has been placed on its exportation, a measure that has been the subject of criticism. The exports of rice amounted in 1912 to $289,411; 1913, $380,690; 1914, $305,484; and 1915, $788,061. During the same period the imports were, 1912, $598,399; 1913, $546,313; 1914, $404,592; and 1915, $603,700. Of the imports since 1911, those from the United States were as follows: 1911 (fiscal year ending 30 June), none; 1912, 30,000 pounds, valued at $1,200; 1913 and 1914, none; 1915, 541,662 pounds, valued at $24,255; 1916, 57,890 pounds, valued at $2,410; and 1917, 493,912 pounds, valued at $21,395.

Costa Rica.— The annual per capita consumption of rice in Costa Rica is at least 100 pounds, it being eaten at least twice a day by every inhabitant of the republic. The total consumption exceeds 30,000,000 pounds per year, from 4,000,000 to 6,000,000 pounds being imported annually, notwithstanding the heavy domestic production, largely on the mountain and hill slopes of the interior of the country. Of late there has been a movement toward the utilization of the swamp lands in the neighborhood of Port Limón, it being practicable to flood these during certain months of the year. The imports of rice — formerly 60 per cent from Germany, 22 per cent from the United States, 10 per cent from England, and the remainder from China and other countries — have lately been as follows: 1913, $143,391; 1914, $160,311; and 1915, $108,649. The amount imported from the United States since 1912 is as follows: Fiscal year ending 30 June 1912, 1,034 pounds, valued at $38; 1913, 4,558 pounds, valued at $152; 1914, 10,236 pounds, valued at $421; 1915, 876,014 pounds, valued at $34,944; 1916, 541,547 pounds, valued at $21,031; and 1917, 195,357 pounds valued at $8,043.

On 28 April 1917, the United States consul at San José reported that the available supply of rice in the country amounted to 1,721,800 pounds, and that the present year's crop, according to government estimates, would be 5,131,600 pounds.

Paraguay.— As regards natural facilities — climate and irrigation — for the production of rice, the conditions in Paraguay are ideal. The production, however, has never been equal to the demand and it is only recently that the government, through the Banco Agrícola, has taken the matter seriously in hand. The area devoted to rice growing in 1915, amounting to 2,480 acres, was more than double that of 1914, and in 1916 the acreage was still greater. The production for 1915 was estimated at 40,000 bushels. The numerous river bottom lands, convenient to the larger population centres, are being investigated and plans are being formulated for the study of the problem of efficient rice culture by Japanese experts. The price of refined rice, 26 May 1915, was $0.14½ per pound, and the domestic production, unrefined, averaged about $0.04 per pound. Early in 1916 the Banco Agrícola instructed its agents that the Committee of Agriculture and Industry, to protect the producers of agricultural products, had authorized the purchase of Paraguayan grown rice in the husk, at $0.2¼ per pound delivered to the agencies of the bank. This minimum price was intended merely to maintain values and did not prevent others from purchasing the product at the same or a higher figure. This activity is within the scheme of the same institution for several years, in purchasing rice in the open market and furnishing it to the poorer classes at cost. Due to the fact that rice appears in the government statistics under the heading of foodstuffs, the quantity imported cannot be estimated. Before the war the greater part came from Germany. Much is purchased through Buenos Aires commission houses. Imports from the United States began with 1915, 37,212 pounds, valued at $2,323; 1916, 44,440 pounds, valued at $2,250.

Ecuador.— Rice is the principal article of diet of all Ecuadorians and is raised locally to a considerable extent. The production varies from 7,500 to 10,000 tons annually, being subject at long intervals to serious droughts. In 1916, due to prolonged lack of rainfall, the crop was reported by the United States consul (23 March 1916) as almost a total failure. The average imports of rice, 1909 to 1913, amounted annually to 4,600 tons, the valuation being, 1909 and 1910, per ton, $44; 1911, $49; 1912, $47; and 1913, $52. In 1916, the price had advanced to between $70 and $75 per ton. The most popular rice consumed is that imported from Peru, the next being the domestic grain, while that from India ranks third. The production is largely in the hands of small farmers and the crop is usually sold or bartered in its raw state to the local merchants, who send it to mill, receiving back 100 pounds of the hulled product for every 160 pounds of the unhulled. There are 19 rice hulling machines in the country. Imports from the United States amounted, in 1911 (fiscal year ending 30 June), to 5,625 pounds, valued at $132; 1912 and 1913, none; 1914, 6,771 pounds, valued at $283; 1915, 127,-

092 pounds, valued at $5,106; 1916, 50,000 pounds, valued at $1,955; and 1917, 709,379 pounds, valued at $37,774.

Remaining States of Latin America.— Special industries and special products of many of the remaining Latin American states are such that the local production of rice is of comparatively small importance, and, while carried on to a greater or less extent, it is included in the statistics of "agricultural products." As an industry, for example, in Bolivia, the United States consul (*Supplement* to *Commerce Reports*, 18 April 1917) states that it has "remained undeveloped because of the lack of adequate means of transportation." The imports of rice for the year 1915 amounted to $209,963, of which the United States contributed $13,530.

Chile raises very little rice, although a great deal is consumed in the country. The United States consul at Valparaiso (*Commerce Reports*, 4 Aug. 1915) states that the annual imports, taken on the basis of the statistics and tables of 1913, total 40,350,340 pounds, valued at $935,281, the United States supplying 99,427 pounds, valued at $2,305; United Kingdom, 484,240 pounds, valued at $11,224; Germany, 15,684,406 pounds, valued at $363,546; Italy, 9,217,532 pounds, valued at $213,649; India, 8,356,536 pounds, valued at $193,695; Java, 80,688 pounds, valued at $1,870; Peru, 5,247,499 pounds, valued at $121,631; all other, 1,180,012 pounds, valued at $27,361. In 1914, the imports amounted to $668,357, and in 1915, $1,106,187. No imports were made from the United States in 1911, 1912 or 1913. In the fiscal year ending 30 June 1914, however, 19,315 pounds, valued at $270, were purchased from the United States; 1915, 1,829,700 pounds, valued at $74,346; 1916, 7,295,271 pounds, valued at $312,387; and 1917, 9,407,693 pounds, valued at $449,940 — a remarkable gain, bespeaking the Chilean appreciation of the United States product.

Colombia consumes vast quantities of rice. As to its domestic production, the United States consul at Barranquilla (*Supplement* to *Commerce Reports*, 30 June 1915) says: "Rice, an important article of consumption, is cultivated by small farmers in a primitive way, the chief implements being a few hides, wooden poles, and a winnowing fan of palm leaves." In view of the favorable climate, the unlimited facilities for irrigation, and, above all, the expressed intention of the government to foster agrarian pursuits, along with the present, increasing price of foodstuffs, the time seems opportune for making rice culture of commercial importance. Prior to the European War, the quantities imported amounted to approximately $800,000 annually, 86 per cent being furnished by Germany. At the present time Great Britain and the United States are supplying the market. During the fiscal year ending 30 June 1912, the United States supplied 73,353 pounds, valued at $2,741; 1913, 45,740 pounds, valued at $2,113; 1914, 17,680 pounds, valued at $629; 1915, 2,584,076 pounds, valued at $98,013; 1916, 8,934,829 pounds, valued at $343,105; and 1917, 3,383,644 pounds, valued at $142,775.

Uruguay is essentially a pastoral country, and, with the exception of wheat, has, until recently, given but little attention to the raising of cereals. As to her imports of rice, the figures are included among other "food products." No imports were made from the United States in 1911, 1912, 1913 or 1914. Those made in 1915 amounted to 93,175 pounds, valued at $4,635; 1916, 48,660 pounds, valued at $2,513; and 1917, 1,758,226 pounds, valued at $88,329.

Venezuela raises a comparatively small amount of rice. According to the United States consul at La Guaira (*Supplement* to *Commerce Reports*, 17 April 1916), "rice is grown, but in far from sufficient quantity, and it is one of the principal articles of import." Imports in 1913 amounted to $288,607, of which The Netherlands supplied $150,986; Germany, $106,088; the United States, $16,281; Great Britain, $9,635; and France, $14,104. In 1914, the imports amounted to $396,906, of which The Netherlands supplied $196,052; Germany, $86,922; the United States, $63,630; Great Britain, $5,837; others not reported. In 1915, the amount was $619,952, of which the United States supplied $424,518; Great Britain, $91,415; Trinidad, $23,866; Spain, $24,029; and France, $656 (*Supplement* to *Commerce Reports*, 17 April and 29 Dec. 1916). According to the reports of the United States Department of Commerce (1915, 1916), the exports from the United States to Venezuela for the year ending 30 June 1912, amounted to 46,388 pounds, valued at $1,490; 1913, 42,650 pounds, valued at $1,589; 1914, 25,018 pounds, valued at $800; 1915, 4,253,399 pounds, valued at $175,408; 1916, 6,559,777 pounds, valued at $262,448; and 1917, 9,411,231 pounds, valued at $424,389.

Guatemala in 1913 raised 3,501,000 pounds of rice; 1914, 22,753,200 pounds; and 1915, 24,015,000 pounds, indicating an increased interest in the development of this industry, a condition resulting from general world conditions and the appreciation of the possibilities, in an agricultural way, of the country. In 1916 the production, due to labor demands for other industries, fell to 13,554,700 pounds, estimated (*Commerce Reports*, 5 April 1917). Rice, being the principal article of diet, large quantities are also imported, the quantity from the United States being, in 1911 (fiscal year ending 30 June), 164,675 pounds, valued at $4,164; 1912, 130,330 pounds, valued at $3,513; 1913, 68,200 pounds, valued at $2,524; 1914, 81,295 pounds, valued at $3,422; 1915, 671,299 pounds, valued at $27,172; 1916, 235,814 pounds, valued at $9,658; and 1917, 181,546 pounds, valued at $7,515.

Honduras, according to the report of the American Consul at Tegucigalpa (*Supplement* to *Commerce Reports*, 7 July 1915), is peculiarly adapted to the raising of rice, but never "on a large scale until highways are built and transportation facilities afforded the people." In a later report, his successor at the same place said (*Supplement* to *Commerce Reports*, 3 May 1916): "Honduras at present imports a vast quantity of rice; yet Honduran rice is considered the best on the market, and available rice lands in the Puerto Cortes district cover a large area." The production in 1915 amounted to 3,252,000 pounds. The imports, 1913–14 (fiscal year ending 1 August), amounted to $82,124, of which the United States supplied $72,218, and Germany, $9,310; 1914–15, total, $112,627, of which the United States supplied $110,194, and Germany, $1,421 (*Supplement* to *Commerce Reports*, 18 Dec. 1916). Evidently on a different basis of valuation, the United States Department of Commerce gives the exports of rice to Honduras as follows: 1912, 1,101,230 pounds, valued at $33,267; 1913, 1,083,045 pounds, valued at $44,599; 1914, 1,501,472 pounds, valued at $65,101; 1915, 2,119,055 pounds, valued at $83,748; 1916 2,264,256 pounds, valued at $90,650; and 1917, 2,601,727 pounds, valued at $115,157.

In Nicaragua «some rice is grown, but not enough for local requirements» (*Supplement* to *Commerce Reports,* 1 Dec. 1915). The imports of this cereal amounted in 1913 to $172,645; 1914, $134,882; and 1915, $145,550. Imports from the United States have been as follows: 1911, 330,393 pounds, valued at $10,242; 1912, 583,476 pounds, valued at $17,328; 1913, 812,911 pounds, valued at $32,448; 1914, 697,612 pounds, valued at $29,719; 1915, 807,672 pounds, valued at $32,601; 1916, 1,164,645 pounds, valued at $46,232; and 1917, 1,529,180 pounds, valued at $62,519.

Panama, although adaptable to agriculture, is in a backward state, due to lack of transportation facilities, the principal industry being that of utilizing the natural products of the country, balata, bananas, etc. While suited to rice culture, very little is raised. The imports of this cereal in 1914 amounted to $351,000. Imports of rice from the United States amounted in 1912, 170,323 pounds, valued at $4,864; 1913, 170,111 pounds, valued at $7,614; 1914, 281,516 pounds, valued at $11,839; 1915, 4,861,604 pounds, valued at $195,031; 1916, 2,300,577 pounds, valued at $90,573; and 1917, 1,959,561 pounds, valued at $93,223. In a report by the United States Consul General (*Commerce Reports,* 14 Aug. 1915), it was stated that the preference in imports was for the grains known as Siam No. 1 and Saigon No. 1, formerly procurable from Hamburg, but purchased at present in San Francisco. Some domestic United States rice has been purchased at New Orleans.

Salvador is one of the Latin American countries raising sufficient rice for its own needs and a surplus for export. In 1914 the area under cultivation was 27,000 acres, producing 12,344,000 pounds. During the same year, the exports amounted to $10,983, of which the United States received $4,032; Guatemala, $2,050; Nicaragua, $3,632; Honduras, $366; Panama, $197; Costa Rica, $702; and France, $4.

Mexico produces a large quantity of rice, but, due to the large domestic consumption, quantities have to be imported every year, particularly at present on account of recent political and industrial troubles. The area under cultivation in 1914 was 41,000 acres, producing 33,921,000 pounds. Figures regarding importation as a whole, for recent years, are not available, but the imports from the United States amounted in 1912, 21,621 pounds, valued at $9,381; 1913, 439,937 pounds, valued at $22,711; 1914, 1,292,466 pounds, valued at $55,573; 1915, 1,742,531 pounds, valued at $76,716; 1916, 6,099,932 pounds, valued at $229,196; and 1917, 7,616,038 pounds, valued at $346,452. In 1914, Mexico exported to Cuba rice to the amount of 1,451,692 pounds, valued at $44,734.

Cuba raises sugar and tobacco, lands are dear and labor is in great demand, a combination of elements that militates against the commercial exploitation of rice in competition with the fields of the Orient. While some rice is raised, its quantity is negligible and as a result the great demand of the island is met by importation. The imports in 1913 amounted to 279,952,741 pounds, valued at $7,772,634; and in 1914, 250,641,198 pounds, valued at $6,529,735. In 1913, Germany supplied, in round numbers, 106,000,000 pounds and British India, 61,000,000 pounds; the respective quantities in 1914 being 44,000,000 and 48,000,000 pounds. Imports from the United States amounted in 1912, 9,140,407 pounds, valued at $246,214; 1913, 669,179 pounds, valued at $28,793; 1914, 11,378,020 pounds, valued at $414,768; 1915, 25,340,501 pounds, valued at $999,810; 1916, 49,127,404 pounds, valued at $1,897,354; and 1917, 21,906,928 pounds, valued at $891,181 — Cuba being the best customer of the United States in this product.

Special Agent Garrard Harris in a report to Washington (*Commerce Reports, 27* Jan. 1916), calls particular attention to the high quality of the rice demanded for Cuban consumption. The varieties in universal demand are the Rangoon, or «Semilla,» as it is generally termed; the Calcutta, otherwise known as «Old Hard Patna,» or «canilla viejo»; the Siam Garden, called «canilla nuevo,» and a small quantity of Valencia rice, the last named in packages and called locally «Bomba,» similar to the Domestic Japan so well known on the New Orleans market.

The Dominican Republic is concerned with the tobacco, coffee and cacao industries and very few cereals are raised, rice being grown to only a small extent. The imports of this cereal in 1913 amounted to $736,751; 1914, $485,776; 1915, $908,876; and 1916, $1,080,068. The United States supplied, in 1911 (fiscal year ending 30 June), 35,000 pounds, valued at $1,007; 1912, 43,703 pounds, valued at $1,498; 1913, 54,290 pounds, valued at $2,367; 1914, 48,750 pounds, valued at $1,418; 1915, 6,706,158 pounds, valued at $289,874; and 1916, 9,301,967 pounds, valued at $369,770.

Haiti, as regards industrial conditions, is closely allied with the Dominican Republic. The production of rice is exceedingly small. Imports from the United States in 1912 (fiscal year ending 30 June) amounted to 71,660 pounds, valued at $2,725; 1913, 109,055 pounds, valued at $4,357; 1914, 33,659 pounds, valued at $1,253; 1915, 6,706,158 pounds, valued at $289,874; 1916, 9,301,967 pounds, valued at $369,770; and 1917, 15,476,048 pounds, valued at $681,837.

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15. RUBBER INDUSTRY IN LATIN AMERICA. Latin America holds the cradle of the rubber industries of the world, in the southwestern section of the great basin of the Amazon, where the «black hevea» is at its best, and Brazil, Peru, Bolivia and Ecuador share in providing its most favored habitat. It was from this region that the first specimens of rubber were sent to Paris by a scientific expedition in 1736. It should be remembered, however, that historical mention of the use of rubber among the native Indians of that country had been made 200 years before, but without attracting serious attention. Although the rubber production of the Amazon basin has been for the last few years overshadowed by the yield of the great rubber plantations of the East, the seeds, plants and stumps with which those plantations were established came from the Amazon and to-day the Amazonian hevea (*Hevea Brasiliensis*) occupies 1,500,000 acres in Ceylon, Sumatra, Java, the Malay Peninsula, southern India, Borneo and Burma. Notwithstanding even these widespread enterprises in cultivated rubber, the fact remains that the most remarkable rubber producing region of the world lies in the valley of the Amazon. It extends from the Atlantic Ocean on the east to the southern boundary of Colombia on the west, a distance of 3,000 miles. This valley, perhaps 200 miles across at the Atlantic end, broadens toward the south until it is 1,500 miles across, comprising a total area of about 2,400,000 square miles. By far the greater part of this territory lies in Brazil, but parts of Bolivia, Peru, Ecuador and Colombia are included. Practically the whole region is covered with forests, and it is estimated that hardly more than 5 per cent of this vast area has been exploited by the rubber gatherers.

In the larger survey, however, Latin America contributes to the markets of the world six different kinds of rubber from as many different species of plants. Their market names and sources are as follows:

Para rubber — obtained from several varieties of *Hevea*, chiefly *H. Brasiliensis*, though usually a mixture, sometimes containing rubber from *Sapium Taburu*, and, separately, that from *Micrandia siphonioides*; produced in the states of Para and Amazonas, the government province of Acre, and the states of Maranhao and the northern parts of Matto-Grosso and Goyaz, of Brazil; and in Peru, Ecuador, Bolivia and southeastern Colombia.

Ceara, or Maniçoba rubber, also Ceara scrap — obtained from several species of *Manihot*, mainly *M. Glasiovii* and *M. dichotoma*; produced in northeastern Brazil, chiefly in the state of Ceara.

Colombia Virgen, or Cartagena scrap — obtained from several species of *Sapium*, mainly *S. Tolimense* and *S. verum*; produced in Peru, Colombia, Venezuela, British Guiana, and localities in Central America.

Mangabeira, or Bahia rubber, and Matto-Grosso sheets — obtained from *Hancornia speciosa*; widely distributed throughout Brazil, but collected chiefly in the states of Bahia, Pernambuco and Matto-Grosso, and to some extent in Minas Geraes, Goyaz and São Paulo.

Caucho rubber, Mexican strips, Centrals, etc.— from species of *Castilloa*, principally *C. Ulei* in Peru and Ecuador, and *C. elastica* in southern Mexico, Costa Rica, Nicaragua, Honduras, Salvador and Guatemala, and in Trinidad and Tobago.

Guayule rubber — obtained from the shrub *Parthenium argentatum*; produced in northern Mexico.

In the Amazonian Basin, where Para rubber originates, there are three districts in which rubber gathering is active, all lying south of the river and along its southern tributaries: (1) The island section, including the numerous islands forming the Amazonian delta and yielding what is commonly termed «island rubber»; (2) a district in the neighborhood of Manaos, including the lower reaches of the Rio Purus and the Rio Jurua and a part of the Rio Negro; (3) the upland districts of Bolivia, Peru and Ecuador. The product of all these districts is known as wild Para rubber, that of the «Up-river» country (above Manaos) being generally «hard cure,» and that from the more easterly sections, «soft cure.» The wild Para rubber of the Amazon Valley is regarded as the best raw rubber supplied to the world's markets. Its excellence is attributed by some authorities to a probable mixing of the saps of several different trees, but by the resident rubber gatherers the superior quality is declared to be due to the soil and climate of the region, which are not duplicated in any of the sections where the same varieties of rubber-producing trees are cultivated in plantations. Whatever the true reason, the industrial fact is that manufacturers hold that the wild Para rubber of the Amazon is absolutely dependable as to quality, while «plantation Para» needs a certain amount of manipulation before it can be worked through the processes commonly employed with unvarying success for wild Para.

The production of Para rubber is largest in the island district, extending from the mouth of the Amazon about 500 miles up the river, and comprising a multitude of low, tide-flooded islands and the low alluvial shores of the main stream and its affluents from the south. Here the principal rubber-yielding tree is the «white hevea,» a variation of *Hevea Brasiliensis*, regarded by botanists as having «migrated» down the river from its original habitat in the upland region near the headwaters toward the southwest. Its white color is attributed to the peculiar whitish lichens which grow upon its trunk in the down-river country. On the higher lands the lichens are dark gray or black, giving rise to the title «black hevea.» This explanation, however, does not account for the decided difference in the cortex of the two trees even when found growing close together, nor for the «red hevea» growing in both districts. The trees are scattered through the forest, generally from 200 to 300 feet apart, although occasionally in groups of two to six. A trail is laid out to cover from 130 to 150 trees, a distance of about six miles. The hevea sap flows very slowly, and requires from 100 to 150 tappings a season. In some sections a new tapping is made every day, in others every other day. At the camps the rubber is separated from the sap by drying out the moisture over a smoky fire made in such a way that the smoke contains a considerable proportion of acetic acid and creosote — a slow process. A great saving of time in this coagulation process has been accomplished by the introduction of a new treatment of the raw sap with a mixture of benzine and wood alcohol.

The output of Amazonian rubber is controlled primarily by the cost of getting the rubber to navigable water, and also to a large degree by the reluctance of laborers to go far into the forests. The population which is depended upon for laborers is apathetic, due to an anæmic condition of health, this in turn being the result chiefly of climatic conditions. The rainy season begins in November, and from March to May the entire river country is subject to flooding, in some localities the waters rising as much as 50 feet. Owing to the low gradient the water is very slow in running off. The impossibility of maintaining roads under such conditions operates oppressively against development of the industry. Whatever rubber collecting is done must begin not earlier than May and be completed by the end of October. On the higher lands toward the western and southwestern part of the basin the rainfall is less and the floods run off more rapidly and the rubber season is longer. Complaint is made that the average laborer works but 100 days in the season, and that in a large part of the rubber-producing region the work could be and should be carried on for 200 days, adding from 50 to 60 per cent to the annual output.

The figures for the 1916 output of wild rubber in the Amazonian region are only partially complete. They show that in that year 17,747 tons were shipped from Manaos to New York and European ports, and that 38,682 tons were shipped from Para to the same destinations, a total from these two principal ports of 56,329 tons. Of the whole, 20,334 tons went to Europe (26,792 tons in 1915) and 35,995 tons to New York (33,597 tons in 1915). The world's yield of plantation (cultivated) rubber for 1916 is officially estimated at 160,000 tons. The latest available complete figures are those for the fiscal year ended 30 June 1913: they are quoted here for purposes of comparison. The output of the Amazon valley in that year was 43,362 tons. Of this 31,362 tons were produced in the upper rivers section, including parts of the Bolivia and Peru rubber districts, and 12,000 tons in the lower Amazon country. As classified, this output consisted of 16,971 tons (39.12 per cent) of «Fine Hard Para»; 8,860 tons (20.44 per cent) of «Entre-fine» and «Fraca» (medium-fine and weak); 7,400 tons (17.07 per cent) of «Sernamby» (scraps and niggerheads); and 10,131 tons (23.37 per cent) of «Caucho.» Outside of this yield other Brazilian states shipped about 4,000 tons, mostly Ceara rubber. The total Brazilian output for that year was therefore about 47,000 tons, or about 40 per cent of the world's production.

The territory which produces Ceara rubber includes the Brazilian states of Ceara, Piauhy and Bahia. The *Manihot* trees from which this kind of rubber is collected thrives on comparatively poor soil, on desert plains and dry hillsides up to an elevation of 3,500 feet above the sea. It withstands the long drought from May to November, and is indifferent to occasional hoar frosts. There are some plantations of the *Manihot* in Brazil, and tapping is begun as early as the second year. The yield of this district is about 4,000 tons annually.

North of the Amazon the *Hevea Brasiliensis* does not grow in commercial quantity, but the *Hevea Benthamiana* is plentiful and yields an excellent rubber. As a rubber district, however, this territory has not been seriously exploited, except in the Rio Araguaya district near the Atlantic coast. *H. Benthamiana* is plentiful also along the river Tocantins, south of the mouth of the Amazon.

In Colombia there are three rubber-producing districts: in the southern and southeastern section, along the valleys of the Japura and Ica rivers and the Rio Negro; in the north, along the valleys of the river Magdalena and its tributaries; and in the northwest in the basin of the river Atrato. The production is chiefly «caucho,» although a considerable quantity of fine Para is collected from the «black hevea» of that section. Heretofore the system of collecting the «caucho» sap has included cutting down the trees, so that the productive area has been constantly diminished. This practice is being regulated by law, and eventually will be abolished. The exports of all rubber from Colombia in 1915 amounted to a value of $91,953.

In Peru the rubber district embraces the departments of Loreto and San Martin and parts of Junin, Huanaco and Cuzco, including the valleys of the rivers Huallaga, Maranon, Ucayali and Putumayo. This region yields some of the finest Para and a much larger quantity of the best caucho. In this country there is a dependable supply of laborers — native Indians — to be had at no other locality in the Amazonian basin.

Bolivia's rubber-yielding territory covers the northern part of that country, including the valleys of the Rio Beni, Rio Mamore, Rio Madre de Dios and other headwater affluents of the Rio Madeira.

The eastern part of Ecuador lies in the most favored section of the Amazonian basin and produces both fine Para and caucho. On the Pacific coast near Guayaquil some plantations have been started.

In Venezuela the rubber country lies along the southern border and along the basin of the Orinoco. The available sources are *Hevea Benthamiana* and *Hevea Guyanensis*. Large plantations have been made in Trinidad and Tobago, but with indifferent results. Other varieties will be tried.

In Panama rubber-gathering is one of the native occupations. The source is a variety of *Castilloa*. In 1915 the exports amounted to 70,604 pounds, valued at $18,874.

In Central America various species of *Castilloa* flourish on both sides of the mountain chain, and small plantations have been established in most of the countries. For some years the collecting of wild rubber was the chief industry of eastern Nicaragua, but the increasing supply of East Indian plantation rubber in the market has so lowered the price that the pursuit has become unprofitable. The same conditions exist in Honduras, the dealers being unable to pay living wages to the laborers. As a consequence, rubber-gathering has nearly ceased.

In British Honduras the rubber industry is carried on along the banks of the Mullins River and in the valleys of its tributaries, along the Sittee River and the Rio Grande in the south and the Sibun River and the upper Belize River in the west. There are also several plantations in the country.

In Mexico, south of the parallel of 22° north latitude, there are no less than nine species of rubber-yielding *Castilloas*, *C. lactiflua* being the most productive. Some of these Castilloas flourish on the Pacific coast, some in the semi-arid regions and others on the humid Atlantic coast lands. The rubber area includes the states of Vera Cruz, Oaxaca, Chiapas, Tabasco and Campeche and the territory of Tepic. In recent years large plantations of Castilloas have been set out in the Soconusco and Palenque districts in the state of Chiapas. The «guayule» rubber country lies in the northern part of Mexico in what is known as the Chihuahua Desert on the great central plateau. It covers an area of about 125,000 square miles, though actually occupying only about one-tenth of the acreage. In general its habitat may be delimited as the Texas boundary on the north, the northern boundary of the Mexican state of Durango on the south, the meridian of Santa Barbara, Chihuahua on the west and the meridian of San Luis Potosi on the east. The plant grows most freely along the lower portions of the slopes and on low ridges, but not on the alluvial bottom lands. As to elevation, it is found on levels from 2,000 feet to 10,000 feet above the sea, but is most plentiful at 6,000 to 6,500 feet, and where the rainfall is from 7 to 10 inches annually. The average stand is about one plant to each square yard. The full-grown plant is 30 to 36 inches high and 40 inches in diameter and weighs from 8 to 10 pounds. The yield of rubber is from 7 to 8 per cent of the weight of the plant. It is estimated that the guayule growth amounts to 500,000 tons, with the total possible yield of 35,000 to 40,000 tons of rubber. The annual output is about 5,000 tons. Formerly, and in some sections to-day, the guayule plants were torn up bodily with the roots, This had the effect of extirpating the plant in those localities. The conservative practice is to cut the plant above the root-stock which sends up new branches, and is ready to be cut again in three or four years. The guayule rubber is of superior quality when a part of its large content (30 per cent) of resin is removed.

The rubber industry of Latin America has had to meet the momentous industrial fact of the rapid increase in recent years of cultivated rubber raised on plantations where labor is plentiful and cheap. This supply has doubled the market offerings since 1908, during which the cost of collecting wild rubber has been continually increasing. To meet the new conditions which still larger yields of plantation rubber will bring into the market situation a reorganization of the labor system and a great improvement in transportation facilities seem imperative, if the wild-rubber industry is to continue prosperous.

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16. SUGAR INDUSTRY IN LATIN AMERICA. The cane sugar production of the world for the past few years has averaged approximately 10,280,000 tons or 22,670,400,000 pounds. Of this quantity the countries of Latin America — not including any foreign possessions in America — produce about 4,138,000 tons or 9,124,290,000 pounds, which is equivalent to more than 40 per cent of the world's total crop of cane sugar. The following tabular statement fairly represents the cane crops of the countries named (in tons):

Cuba	3,000,000	Mexico	89,000
Argentina	336,000	Central America	35,000
Peru	263,000	Venezuela	20,000
Brazil	240,000	Paraguay	2,821
Dominican Republic	150,000	Colombia	1,667

The United States, the largest consumer of sugar per capita of all other countries, in 1915–16 imported from all sources 2,455,366 tons or 5,414,081,941 pounds of cane sugar, and of this quantity 2,451,329 tons or 5,405,180,430 pounds were imported from Latin America, leaving only 4,037 tons or 8,901,585 pounds brought in from all other countries. Our imports from Latin America increased from 1,963,485 tons in 1912–13 to 2,451,329 tons in 1915–16, or 25 per cent.

Cuba.— The republic of Cuba is now the largest cane-sugar-producing country in the world. For a long time it ranked next to British India, but since the establishment of the republic it has risen to the first rank. These two countries together furnish approximately one-half of the world's supply of cane sugar, each producing from two to more than three million tons.

Climatic conditions and the soil of Cuba are so well adapted to the growing of sugar cane that nearly one-half of the tillable area of the island is devoted to this crop. The cane matures in from 12 to 18 months, but the crop is so planted that it is harvested more or less throughout the year, though the principal harvest season is from December to June. The lands in the western provinces have been planted in cane so many years and have become so impoverished that not more than four to seven crops can be harvested without replanting. In the newer and richer lands of the eastern provinces 10 or 12 crops and sometimes twice as many may be harvested without replanting. Recent statistics show that the yield of sugar per acre was 4,900 pounds harvested from 1,384,812 acres. The Cuban sugar factories have been greatly improved within the past few years. Keen competition has forced Cuba to adopt more economical methods in the manufacture of sugar, and this has resulted in an almost constant decline in the number of factories, but an increase in their size and capacity. Some years ago there were 473 factories, but now there are only 190 to 200. The plantations are equipped with private railway lines to transport the cane from the fields to the factories. There are approximately 3,000 miles of these railways.

Recent statistics show that of the total area under cane about 56 per cent was either cultivated or controlled by the factory owners, while 44 per cent was cultivated by independent farmers who sold their cane to the factories. As an incentive to produce high grade cane it is paid for according to the sugar content and not the gross weight. During the 10 years ending with 1912–13 there was an average of 175 factories in operation, which ground an average of 15,925,000 tons of cane annually and produced 1,687,000 tons of sugar, or 3,778,880,000 pounds annually. The production since 1912–13 in tons is as follows: 1916–17, 3,000,000 tons; 1915–16, 3,007,915 tons; 1914–15, 2,592,667 tons; 1913–14, 2,597,732 tons. The greater portion of the Cuban crop of sugar is exported, the average the past 20 years being about 95 per cent, of which the United States has taken about 90 per cent. In 1913 the United States took 2,129,748 tons, valued at $107,975,360, and 2,164,621 tons valued at $116,479,869 in 1914. Great Britain took 240,870 tons, valued at $12,598,817, in 1913, and 231,541 tons, valued at $10,910,416, in 1914. The total exports in those years were 2,411,188 tons, valued at $122,388,062, in 1913, and 2,454,334 tons, valued at $130,413,769, in 1914. In 1915 the United States imported 2,136,110 long tons of sugar from Cuba, and 2,299,488 long tons in 1916. The following values of the sugar crops since 1910 will serve to indicate the remarkable growth of this industry, as well as how prosperity has come to Cuba in recent years:

1911–12	$121,468,000	1914–15	$205,000,000
1912–13	115,395,000	1915–16	250,000,000
1913–14	130,424,000	1916–17	246,000,000

Dominican Republic.— The sugar plantations of the republic are located on the southern coast. In the adjoining hinterland are many of the most important sugar centres of the island, namely, Angelina, Consuelo, Porvenir, Cristobal, Colon, Santa Fé and Quisqueya, and the value of the sugar exported through the chief sugar port, San Pedro de Macoris, in 1915 amounted to over $3,000,000.

The sugar land extends along the coast, and going westward in the vicinity of the city of Santo Domingo are to be found the centrals Italia, San Isidro and San Louis, and toward the western border of the republic in the Azua and Barahona district Azana, Ocoa and Ansonia estates. Nearly all of these sugar estates have prospered greatly in recent years. The sugar acreage is increasing annually and new centrals are in process of construction.

The soil is well adapted for sugar cultivation and produces on an average 25 years of ratoon crops with an output of 70 tons of cane per acre from virgin land during the first year. The sugar season extends from December to June or July. The local labor supply is limited, and in normal times is increased by importations from the nearby British West Indies.

The estimates in tons of the sugar crops of the three seasons, 1914 to 1917, are as follows:

DISTRICT	1914–15	1915–16	1916–17
Macoris	75,970	91,738	112,273
Santo Domingo	20,205	21,925	33,906
Asua	3,472	5,071	5,812
Total	99,647	118,734	151,991

The imports of raw sugar into the United States from the Dominican Republic were 1,927 tons in 1914, 34,012 tons in 1915 and 47,992 tons in 1916.

Peru.— The area suitable for growing sugar cane on the west coast of Peru is limited only by the available supply of water for irrigation. There is also a small area east of the Andes planted in cane, but at least 97½ per cent of the crop is grown in the rich valleys along the coast. The crop is planted and harvested throughout the year, but the principal harvest season is from October to February. The cane in the coast region requires 18 to 20 months to mature and from 8 to 12 crops may be harvested from one planting. The area of cane under cultivation is about 101,000 acres. The number of laborers employed in the industry is estimated at 21,881. The average production per hectare of 2.471 acres is a little over 10 metric tons (equal to about 4½ short tons per acre). In the Chicama Valley where there are a number of fine modern mills the production runs as high as 13½ metric tons per hectare (equal to a little more than six short tons per acre).

The growth of the sugar industry of Peru may be seen from the following, showing the yield in metric tons for the years specified of white and granulated, muscovado and Chancaca sugar. The exports for the same years are given as an indication of the growth of this branch of the industry:

YEAR	Production, tons	Exports, tons
1912	192,754	147,410
1913	183,954	142,901
1914	228,054	176,670
1915	262,840	220,257

The disposition of the crop of 1915 to the various countries was in the following proportions: Chile, 39.93 per cent; United States, 21.69 per cent; Great Britain, 17.80 per cent; Spain, 4.17 per cent; Bolivia, 1.68 per cent; consumed locally or stored, 18.73 per cent.

From 1911–16 the United States imported the following amounts of raw sugar from Peru, the imports in the last two years being remarkable as compared with former years: 1911–12, 5,917 tons; 1912–13, 6,201 tons; 1913–14, 3,126 tons; 1914–15, 32,252 tons; 1915–16, 37,549 tons.

Mexico.—Almost the whole of the lowland region of Mexico is adapted to growth of sugar cane, and it is grown in 18 of the 28 states, but approximately one-half of the crop is produced in the two states — Morelos and Vera Cruz. The two other states of most importance are Puebla and Sinaloa. In the lowlands along the coast as many as 10 crops may be harvested from one planting. In this region very little cultivation is needed, and the yield has been as high as 35 tons to the acre. Owing to the disturbed condition of the country the sugar industry has not made the progress that may be noted in other Latin-American countries and very little modern machinery is in use, the old open-kettle process being still mostly in use, which extracts only about 6 per cent of sugar per weight of cane.

Notwithstanding the continuous revolutions of recent years the quantity of sugar produced in Mexico increased considerably, until the past two seasons. The crop of 1903–04 decreased from 112,930 to 102,931 in 1905–06, increased to 178,134 in 1910–11, decreased to 167,258 in 1911–12, to 143,000 in 1913–14, and to 121,000 in 1914–15. But the crops of the last two seasons are estimated at only 65,000 tons for 1914–15, and 50,000 tons for 1916–17. The quantity of sugar, in tons imported into the United States from Mexico in recent years, is as follows: 1913–14, 922 tons; 1914–15, 34,371 tons; 1915–16, 6,636 tons.

Brazil.— The cultivation of sugar cane, one of the oldest industries of Brazil, owing to increased demand for sugar, has again been revived and promises to assume much greater importance. It is now grown in more than half the states, from the mouth of the Amazon down to the Laguna Mirim. The most flourishing centres of sugar production are in the state of Rio de Janeiro, where Campos is the focus of sugar deliveries, and Pernambuco, a thousand miles farther north; São Paulo has also an increasing sugar industry as may be seen from the following list of large sugar mills in each state: Alagôas, 9; Bahía, 7; Maranhão, 3; Minas Geraes, 7; Parahyba, 2; Pernambuco, 46; Rio de Janeiro, 31; Santa Catharina, 2; São Paulo, 20; Sergipe, 15; Piauhy, 1; Rio Grande do Norte, 3; total, 139.

The cane is planted at the beginning of the rainy season and is harvested from 12 to 18 months later in the southern states and from 11 to 14 months in the northern states. From 4 to 6 crops are cut from one planting. The yield of cane per acre varies from 15½ to 16½ tons, depending upon the character of the soil and season. The sugar extraction is low compared with other cane-growing countries and ranges from 4 to 9 per cent of the weight of the cane. The low yield is due mainly to continuous planting in the same soil for many years. The sugar production in recent years is as follows: 1912–13, 343,000 tons; 1913–14, 203,394 tons; 1914–15, 240,000 tons; 1915–16, 194,000 tons.

The principal markets for Brazilian sugars are Great Britain, the United States, Uruguay, Bolivia, Chile, Peru, Cape Verde and France. The exports to the United States increased from 312 tons in 1910–11 to 14,937 tons in 1914–15 and to 9,095 tons in 1915–16.

Colombia.— Sugar cane grows in the rich valleys of Colombia year after year without replanting, and it is said that there are fields in the valley of Cauca that have been harvested every year for nearly a century without renewal, although in Cuba the cane yields only from 5 to 10 crops, and in many sugar-producing countries it must be set out every year. The yield of each hectare (2.47 acres) is also very high, being 800 to 1,000 quintals (112 pounds), in comparison with 600 to 800 in Cuba and 900 to 950 in Hawaii; and with irrigation, which is available without much difficulty on account of the nature of the land, the yield would be still higher.

There are no statistics available, other than the exports to the United States, that would indicate the production of sugar in Colombia, though it is well known that the industry has shown a rapid development in recent years. The imports into the United States in 1910–11 amounted to 2,447,314 pounds, but for some unaccountable reason there appears to have been no receipts from that country either in 1911–12, 1912–13 or 1913–14. In 1914–15 the imports reached 3,675,812 pounds, and in 1915–16, 3,376,700 pounds.

Guatemala.— Next to coffee, sugar is the most important crop of Guatemala. While the cane flourishes in almost every region from the level of the sea to an altitude of 5,000 feet, the chief sugar districts are in the provinces of Escuintla, Mazatenango and Solola, all on the Pacific coast. The principal variety cultivated, known as «Jamaiquina,» was brought into the republic from Jamaica. The area devoted to sugar in 1916 was 76,352 acres. The average production is about 4,200 pounds per acre. In the Pacific coast region there are 20 sugar mills. The grades of sugar manufactured are 86 to 89 brown sugar and from 96 to 99 white sugar. The quality is said to be excellent and there is a large local demand for the product. The sugar exported is principally the raw product known as «moscabado.» The following are the estimates of the production of sugar in tons for the years named: 1913, 10,884 tons; 1914, 11,338 tons; 1915, 13,605 tons. In 1915 10,918,800 pounds, equal to 4,952 tons, were exported, all of which was sent to the United States and Central American countries. The exports to the United States for the years named are as follows: 1913–14, 1,258,202 pounds; 1914–15, 3,193,297 pounds; 1915–16, 3,459,144 pounds.

Costa Rica.— The cane sugar lands of Costa Rica are located in the central and Pacific coast regions. About two-thirds of the cane area is in San José and Alajuela, and one-third on the Pacific coast. The area devoted to cane increased from 25,590 acres in 1905 to 27,636 in 1907–08, to 32,331 in 1910, but decreased to 29,474 in 1914. The high prices and great demand for sugar has, however, undoubtedly resulted in a considerable addition to the area since 1914. This is plainly evident from the fact that Costa Rica exported to the United States 1,598,737 pounds of raw sugar in 1915 and 4,947,289 pounds in 1916, whereas previous to these dates the crops did not meet the local demand and sugar had to be imported every year. The cane grown along the coast ripens in about 18 months, while that grown in the more elevated regions of the interior requires 24 months to ripen.

Venezuela.— The high prices and great demand for sugar have resulted in plans being consummated for its manufacture on a large scale in Venezuela. The progress already made is evidenced from the large increase in the exports of raw sugar the past two years. The sugar plantations in the vicinity of Caracas are all under irrigation, and the same is true in lesser degree of the plantations in the states of Aragua and Carabobo. The most remarkable cane in the republic grows around and especially at the south end of Lake Maracaibo, where four big centrals are in operation. It is said that the cane at the south end of this lake produces readily for 25 years.

The exports of cane sugar from Venezuela to the United States in 1910–11 amounted to 653,077 pounds and in 1911–12 to 269,530 pounds. There were no exports worth mentioning in either 1912–13, or 1913–14. In 1914–15 there was a revival of this trade and 330,789 pounds were sent to the United States and the year following 8,293,531 pounds.

Argentina.— The cane sugar lands of Argentina are located in the northern part of the republic, chiefly in the province of Tucumân, which comprises about 80 per cent of the total area planted. In 1912–13 this province contained 72 per cent of the sugar mills, and produced 84 per cent of the cane and 83 per cent of the sugar. The principal harvest season is from 1 June to 31 October. The yield per acre is estimated at from 10 to 20 tons. The production of sugar increased from 157,513 tons in 1903–04 to 304,389 tons in 1913–14. The domestic supply of sugar in Argentina is approximately equal to the demand. Some years the production exceeds the home demand and the surplus is exported. At other times the short crops necessitate the importation of a considerable quantity, as was the case in 1913 when 83,289 tons were imported, and again in 1916 when 75,000 tons were imported. But meanwhile (1914) 71,308 tons were exported. The government, to encourage the industry, pays a bounty on all sugar exported. A maximum price has been fixed by law which is equal to the import duty; when the price of domestic sugar exceeds the price fixed by law, sugar is imported to equalize prices.

The production of cane sugar the past five years is estimated as follows: 1912–13, 221,004 tons; 1913–14, 280,319 tons; 1914–15, 335,833 tons; 1915–16, 152,301 tons.

There are 37 mills in the republic, with an estimated capital of $31,594,882. The annual sales of these mills is put at $19,841,855, and the raw material employed is valued at $7,820,907.

Other Latin-American Countries.— There are no available data or statistics for other

Latin-American countries producing cane sugar, but in addition to the countries already reviewed (and excluding European colonies) considerable quantities of sugar are produced in Salvador, Nicaragua, Panama, Haiti, Honduras and smaller quantities in Bolivia, Ecuador, Paraguay and Chile. The imports from these countries into the United States are given in the introductory table, which will in some degree indicate the production of those countries.

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17. TOBACCO INDUSTRY IN LATIN AMERICA. Argentina.— The domestic production of tobacco in the Argentine Republic is used exclusively in the domestic cigar and cigarette factories. Due to its medium and inferior quality it is used for the cheaper grades of consumption, either by itself or mixed in proportions of 50 per cent or 55 per cent with the imported leaf. In 1895 the number of acres under tobacco cultivation was 39,030, and in 1912, 23,860, a decrease attributed to the high internal revenue taxes and the low import duties for the imported product. In view of this phase of the Argentine tobacco situation, the Section of Tobacco of the Argentine Department of Agriculture in July 1916 issued a report on the subject, in which it was stated that, despite the inferior quality of the product, it was of domestic importance, and recommendations were made to increase both the acreage and quality, the latter by the introduction of the approved scientific methods of cultivation and handling, as otherwise the domestic leaf will continue selling in the market for a third of the price of the imported leaf. The production for the decade, 1903–13, in pounds, was 149,995,150.8, the individual years being as follows: 1903, 8,382,675.4; 1904, 17,749,214.4; 1905, 18,417,847.8; 1906, 8,312,191.8; 1907, 10,051,960.6; 1908, 13,750,024.2; 1909, 21,829,029.2; 1910, 15,146,760.2; 1911, 12,825,696.4; 1912, 12,241,435.8; and 1913, 11,238,315, showing a wide variation in the amount raised, the greater part of which is cultivated in the provinces of Corrientes, Salta and Tucumán, all situated in the northern part of the republic.

The principal tobacco consumption of the country is of cigarettes, most of which are of domestic manufacture, and retail, per box of 14, for from 4¼ to 17 cents, the demand for foreign cigarettes being supplied chiefly by the foreign element. Of cigars, the «Toscano,» an Italian imported cigar, is the most popular, retailing for four and one-fourth cents, and an Argentine imitation known as the «Avanti,» retailing at two and one-twelfth cents. The well-to-do Argentinian smokes Habanas exclusively; in addition there are various Brazilian, Dutch and German brands that have a considerable sale. Very little tobacco is chewed. The imports during the five-year period, 1908–12, were as follows: Habana leaf, 1,587,344 pounds; Paraguayan, 2,554,665 pounds; others, 10,604,643 pounds, of which about 70 per cent came from Brazil and 18 per cent from the United States. Of manufactured tobacco during the same period, 74,097 pounds from Uruguay, United Kingdom, Cuba, Italy, France, Spain, Egypt, etc.; Habana cigars in boxes, 87,989 pounds; other cigars in boxes, 2,044,902 pounds — three-fourths from Italy and the remainder largely from Switzerland and The Netherlands; other cigars, not in boxes, 55,193 pounds — Switzerland and Italy; cut tobacco («picadura»), Paraguay, 7,738 pounds, and other, chiefly United Kingdom, 4,969 pounds; and snuff, 6,534 pounds, Italy and France.

Brazil.— Brazil, of the Latin-American countries, is the greatest producer of tobacco, an industry that has been carried on since the days of the colonial governments. In 1796 the exportation of tobacco to Portugal amounted to more than 18,000,000 pounds, an amount that has steadily increased since that time until the formation of the republic, since which time, due to labor conditions, the production has changed but little, being conservatively estimated at 77,640,000 pounds annually. In 1912 the exports amounted to 54,449,820 pounds; in 1913, 64,771,152 pounds. Ninety-five per cent of the exports are made from Bahía, the chief port of the tobacco district, and the greatest amount is sent to Europe. Taken in its entirety tobacco is the sixth in size of all Brazilian exports, the republic, besides supplying her own domestic needs, supplying the greater part of the requirements of her neighboring countries. Besides the state of Bahía, the entire east coast is interested in tobacco cultivation, particularly the state of Maranhão, and lately it has become an industry of future promise in the states of Rio Grande do Sul, Santa Catharina, Minas Geraes and Pernambuco. The average exports from Bahía to the other non-producing parts of Brazil is about 6,600,000 pounds annually, in addition to about $500,000 worth of cigars, cigarettes and other elaborated tobaccos. In 1915 these last amounted to 37,000,000 cigars and 17,000,000 cigarettes.

Prior to the outbreak of the European War 40 per cent of the exports went to Hamburg, 40 per cent to Bremen and 17 per cent to Argentina, with practically none to the United States, the figures being as follows: 1913, total, 29,388 metric tons (2,204.6 pounds), of which to the United States, 6; Germany, 24,473; Argentina, 4,359; Uruguay, 343; 1914, total 26,980, of which to the United States, 192; Germany, 22,133; Argentina, 2,873; Uruguay, 664; 1915, total 27,096, of which to the United States, 1,953; Germany, 1; Argentina, 7,302; Uruguay, 866; the Netherlands, 3,980; and France, 6,581. The shipments made to the United States were largely for re-export and for temporary storage to avoid the tobacco worm prevalent in Brazil. Imports of tobacco leaf, for blending with the domestic leaf, were, 1914, total, $386,069, of which the United States supplied $100,136; Holland, $60,805; Turkey in Europe, $30,818; China, $40,202; and Cuba, $16,012.

Cuba.— While Cuba is not as great a producer of tobacco as certain other countries, the reputation that its raw and manufactured product has achieved has made the name Habana synonymous for excellence of tobacco, a reputation that the island has held since its first discovery. Next to sugar, it is Cuba's most important crop. The manufactures of this staple amounted in 1913 to $29,014,114, of which 387.376.230 cigars were valued at $22,055,008; 289.334.064 packages of 16 cigarettes valued at $6,516,344; 918,590 pounds of cut tobacco, valued at $442,762. In 1914 the total was $23,564,686, of which 312,767,343 cigars were valued at $17,626,391; cigarettes, 247,872,578 packages of 16, valued at $5,574,887; 770,829 pounds of cut tobacco, valued at $363,408, a general decrease in every class. In addition there remained leaf to the amount of $18,093,754 unmanufactured. Of the cigars manufactured in 1914, 188,816,225 were consumed in Cuba, and 123,951,118 exported. The exports for the year 1914 amounted to $26,353,170, divided as follows: Leaf, $16,584,078; cigars, $9,129,661; cigarettes, $429,147; and cut tobacco, $210,284. Of the leaf tobacco the number of bales exported in 1913 was 322,121; in 1914, 314,732. Of these amounts the greatest buyer was the United States, 1913, 259,758; 1914, 239,922; followed by Germany, 1913, 20,572; 1914, 18,838; Canada, 1913, 16,880; 1914, 7,861; Spain, 1913, 4,518; 1914, 25,802; and Argentina, 1913, 12,102; 1914, 10,281. Of cigars exported in 1913, the number was 183,226,330, the nine countries buying more than 1,000,000 each being: England, 66,842,801; United States, 53,577,563; Germany, 14,028,326; Canada, 13,319,147; France, 9,362,492; Australia, 6,316,505; Spain, 5,428,515; Argentina, 3,928,061; and Chile, 3,488,234. Of the 123,951,118 cigars exported in 1914, the nine countries buying more than 1,000,000 were: England, 43,951,994; United States, 37,732,728; Spain, 8,274,730; Canada, 8,229,412; France, 7,230,825; Germany, 5,187,946; Australia, 5,121,363; Chile, 1,730,502; and Argentina, 1,146,432. In 1917 the total exports of leaf and manufactured tobacco amounted to $22,617,648, a decrease of about $2,500,000 in leaf and $1,800,000 in manufactured tobacco, caused in part by the European War and in part by the deflection of the ordinary transport service. This resulted in a depression among tobacco growers and a disorganization among labor, the result being that many of the plantations were temporarily planted with sugar cane, due to the great demand for this commodity.

In Cuba the greatest attention has been paid to the scientific raising of tobacco, so that the product of each locality has its special characteristic, it being said that the poorest tobacco grown on the island is equal to the best grown elsewhere. The highest prized, as being the choicest cigar leaf in the world, is the «Vuelta Abajo,» grown in the province of Pinar del Rio, near the western end of the island. It in turn is divided into other classes known as «Mantua,» «Remates,» «Guane» and «Vinales,» all of the heavier type, used in blending, «San Luís» and «San Juan y Martinez,» superior wrapping leaves, «Rio Hondo,» aromatic, «Consolación del Sur,» «Pinar del Rio,» and the less desirable grades known as «Bajas,» «Consolación del Norte,» and «Parti Sur.» The annual production of these is about 250,000 bales. Likewise in the province of Pinar del Rio is the «Simi-Vuelta,» heavy and aromatic, a favorite with smokers in the United States, and produced to the amount of about 20,000 bales annually. In the province of Habana, with an annual yield of about 80,000 bales, is the «Partidos,» lighter in quality than the «Vuelta Abajo,» and producing a desirable wrapper leaf. Of its subdivisions, the «Tumbadero» is the most prized, followed by «La Salud,» «Artemisa,» a filler, «Govea,» supplying wrappers, «Bejucal,» and its three ordinary classes, «La Seiba,» «Wajai Caimito» and «San José de las Lajas.» The province of Santa Clara is noted for its «Remedios,» a name that is erroneously applied also to tobaccos grown in the province of Camagüey. Santa Clara produced also another excellent leaf, the «Santa Clara,» in addition to other classes, less known, called «Cienfuegos,» «Colonia,» «Santo Domingo,» «Sagua» and «Trinidad,» all of the last four named being substituted at times for «Remedios.» Another, and a medium grade, is the «Sancti Spiritus,» also of Santa Clara. The province of Oriente produces the «Yara,» the least desirable of all Cuban tobaccos, subdivided into «Mayri» and «Gibari.» The annual yield of «Yara» is about 12,000 bales, exported chiefly to Germany, Canada and Central America. Its leaves are heavy and coarse, and being totally unlike the other grades, is unsuitable for use in cigars for export.

For the purpose of protecting the reputation of tobaccos and cigars produced in Cuba, a law was passed on 16 July 1912, providing for a national collective trade mark on the containers of all tobaccos and tobacco products intended for export, under heavy penalties, and in consequence the Bureau of Agriculture, Commerce and Labor registered a distinctive mark for each, «tobaccos and cut tobacco» and «cigars manufactured in Cuba.»

Paraguay.— The most widely cultivated, although not the most important, crop in Paraguay is tobacco. Its production was formerly carried on on an extensive scale, and a ready market was found in Europe, particularly in Germany, but due to internal troubles its acreage decreased and until recently it was practically unknown beyond the Paraguayan borders. It is now under the special patronage of the Banco Agrícola, the government institution concerned with betterment of agricultural matters. Soils have been analyzed, seeds from Cuba introduced and scientific instruction given as to the cultivation and handling to meet the demands of export buyers. In 1910 a regulation was passed providing for the classification under the Tobacco Revision Office (Oficina Revisadora de Tobacos) as follows: «Pito,» «Media,» «Regular,» «Buena,» «Doble,» «Pará 1a,» «Pará 2a,» and «Fuerte,» the «Pito» to «Buena» being mild, and «Doble» to «Pará» strong, to standardize the production and prevent fraud, unclassified exports being subject to a special export tax.

The exports in 1900 amounted in pounds to 6,590,644; 1901, 5,103,265; 1902, 6,200,014; 1903, 7,012,870; 1904, 9,997,724; 1905, 7,980,119; 1906, 5,076,104; 1907, 3,391,762; 1908, 10,977,164; 1909, 10,580,998; 1910, 11,259,230; 1911, 14,219,781; 1912, 8,842,216; 1913, 11,897,609; 1914, 9,908,921; and 1917, 13,479,000. The great bulk of the lighter grades is exported to Europe, more than half going to Amsterdam and Bremen, being in large part destined for the Spanish trade. Of the heavier grades Argentina is the greatest buyer.

Chile.— In the year 1913 there were under cultivation in Chile 3,430 acres of tobacco, producing 8,523,645 pounds. For 1914, with a slightly smaller acreage, the production was 6,282,228 pounds. All of this was consumed in the republic. In addition there were imported, in 1913, 411,031 pounds of tobacco, valued at

$456,384, of which 115,181 pounds were cigarettes, valued at $229,032; 67,623 pounds cigars, valued at $111,943; 156,762 pounds, leaf tobacco, valued at $77,913; and 71,465 pounds cut tobacco, valued at $41,406. The cigarettes were imported from 16 countries, of which France supplied 27,119 pounds, Belgium, 25,097 pounds, Cuba, 24,286 pounds, Great Britain, 19,923 pounds, Germany, 9,217 pounds, the reminder from other countries, the United States being credited with 888 pounds. Of the cigars, Cuba supplied 36,854 pounds; Italy, 7,553 pounds; Germany, 8,305 pounds; France, 3,640 pounds; Panama, 3,494 pounds; Great Britain, 3,225 pounds; and Belgium, 3,045 pounds, the remainder being distributed among seven other countries, the United States supplying 547 pounds. Of the leaf tobacco, Cuba supplied 131,548 pounds; Germany, 11,224 pounds; the United States standing third with 3,741 pounds; the remainder being distributed among eight other countries. Of the cut tobacco, Cuba supplied 22,297 pounds; France, 14,850 pounds; Belgium, 11,173 pounds; Great Britain, 11,164 pounds; the United States standing fifth with 6,292 pounds, the remainder being distributed among six other countries. According to the United States *Commerce Reports,* the imports in 1914 of leaf tobacco amounted to $66,135, cut tobacco $40,369, cigars $78,876 and cigarettes $157,106, a total of $342,486; and in 1915, the imports of leaf and cut tobacco amounted to $129,377.

In 1913 there were 192 tobacco factories in Chile, of which 59 were located in Valparaiso and 61 in Santiago, 129 being of Chilean ownership and 63 belonging to foreigners. The number of persons employed was 1,960, and the value of their production, from foreign and domestic leaf, was $3,338,807. The greater part of the manufactures was of cigars, with a small portion of cigarettes, and a still smaller one of smoking tobacco. The favorite form of tobacco is the cigarette, the domestic being the cheapest. Of the foreign brands, nearly all the well-known English cigarettes are sold, as well as the French, Italian, Cuban, Turkish and Egyptian, the black Cuban type being a favorite by a large percentage. Of cigars, the Cuban and Mexican are most popular. Due to the war many of the lighter brands of European cigars and cigarettes have been unobtainable, a deficiency that is beginning to be supplied by the United States.

Colombia.— With proper encouragement, Colombia promises to be one of the important tobacco producing countries of America, as the plant thrives in almost every portion of the country. It is even claimed that certain small sections produce a quality rivaling the Cuban tobacco. Due, however, to the failure to adopt approved scientific methods of raising, handling and grading, the qualities of the better grades are not uniform from year to year, and for export purposes the whole crop is considered under one standard — a leaf of average quality, largely used as filler. The country produces more than sufficient for domestic consumption, quantities being raised near the coast and in the department of Santander, while the leaf of the best quality comes from the district of Ambalema, where also the greatest quantity of tobacco is found.

The exports of tobacco (mostly leaf) in 1913 amounted to 13,811,000 pounds (estimated); and in 1914, to 5,806,737 pounds, valued at $393,096; 1915, 4,562,122 pounds, valued at $334,642. Of the total amount, 5,089,342 pounds, exported in 1914, from the port of Barranquilla, 5,089,893 pounds were consigned to Europe, and 15,449 pounds to the United States. Of the amounts shipped from the port of Cartagena in 1914 and 1915, the respective figures are as follows: France, $378 and $52,476; Germany (1914 only), $149,371; Great Britain (1915 only), $29,583; United States, $3,051 and $31,810; other countries, $26,100 and $25,404. During the fiscal year ending 30 June 1916 the amount exported to the United States was $35,325, of which $1,013 was cigar wrappers and $34,325 leaf.

The decline of exports following 1913 is indicative also of the reduction of the quantity raised, the reduced demand by Germany — the greatest customer — being discounted by the utilization of much of the former tobacco acreage for other purposes. Notwithstanding this, the immediate result of the European War was the sharp breaking in prices, in June 1915, being as low as $0.06 per pound, a fact that has been discouraging to the industry. Some relief is afforded, however, to the native industry by the increase (1915) of duties on imported tobaccos, leaf and manufactured, from 80 cents to $1 per kilo (2.2046 pounds), in connection with the high internal revenue taxes. There is necessarily a demand for foreign tobaccos for blending purposes, in addition to special demands for the manufactured product. Of manufactured and leaf tobacco imported in 1915, amounting to $148,433, the United States furnished a large percentage.

Costa Rica.— The importance of the banana and coffee industries in Costa Rica has made of tobacco growing a lesser industry serving at present for domestic demands. This notwithstanding the fact that its production is a success, the climate and soil being favorable. In 1914 the number of acres under tobacco cultivation was 2,734. Partly as a means of revenue, and partly to protect the domestic tobacco interests, the government has levied a very high duty on the imported product — about $0.85 per pound, plus a surtax of 5 per cent on imports for consumption at Port Limon. The result has been that, due to the high prices necessarily demanded for imported tobaccos and cigars, local factories have been lately established throughout the republic, a very large one being located at San José. This local demand has encouraged the growing of the native leaf, with a result that imports have decreased by half, the imports being largely of foreign cigars and cigarettes for which there is a special demand. The quantity of tobaccos exported is negligible. The imports through Port Limon in 1914 amounted to $124,000 of which the United States supplied $52,000; Germany, $15,000; Great Britain, $18,000, and France, etc., $39,000. For 1915, the imports at the same port amounted to $37,100, of which the United States supplied $31,200; Great Britain, $10,000, and France, etc., $5,900.

Dominican Republic.— Of all the Latin-American countries, the Dominican Republic at present ranks third in the raising of tobacco, the production for 1913 being 28,000,000 pounds, and the normal yield annually being 17,250,000 to 23,000,000 pounds. Due, however, to internal troubles, the production decreased somewhat in 1914 and 1915, the yield for the latter year being between 6,900,000 and 8,050,000 pounds, which was increased in 1916 to (estimated) between 23,000,000 and 25,000,000 pounds.

The exports of tobacco leaf from the country in 1913 amounted to 21,539,876 pounds, valued at $1,121,775, of which Germany received 20,099,803; the United States, 285,412; France, 355,400, and other countries, 788,260. In 1914 the amount exported was 8,152,208 pounds, valued at $394,224, of which Germany received 7,286,382; the United States, 128,953; France, 78,492, and other countries, 653,981. In 1915, 13,717,900 pounds, valued at $972,896, of which the United States received 7,624,839; France, 1,944,872, and other countries, 4,146,188. In 1916, 17,438,332 pounds, valued at $1,433,323, of which the United States received 6,825,584; France, 1,278,746, and other countries (unspecified), 9,334,002.

Ecuador.— Ecuador produces some excellent qualities of tobacco, it being claimed that for delicacy of flavor they are the equal of the best Cuban. The acreage is scarcely more than enough for domestic requirements, and the methods of raising and handling are not such as bring out its best qualities. The greatest quantity is raised in the Guayas fluvial region and in the province of Esmeraldas. In 1914, 107,616 pounds of leaf tobacco, valued at $19,922, were exported, the amount for 1915 being 596,445 pounds (to Peru), valued at $89,825, an increase that is due to the encouragement of the government.

In October 1915, a law was passed, effective 1 Jan. 1917, for the government control of the tobacco industry, raising, manufacturing and selling, on the basis of concessions to producers and selling agencies. By its provisions, the production and manufacture are exempt from all fiscal taxes; written notice to the competent authority is required of all persons desiring to raise tobacco, and license is given without charge. Subject to confiscation, tobaccos and products may not be transported from one place to another, even in the same town, without a permit. Taxes were provided for all tobaccos on hand on 1 Jan. 1917, and in the future the privilege of selling tobaccos is to be auctioned annually, for the various districts or provinces, or for the whole republic, fiscal taxes being likewise imposed upon the concessions, varying from $87.60 to $4,672.

Guatemala.— In quality, Guatemalan tobacco ranks high. Due, however, to antiquated methods of handling it, it has not acquired the commercial value that its qualities merit. It is raised throughout the republic, but the favorite leaf is produced in the vicinity of Zacapa, at Barberina and vicinity, and also at Chiqumulilla on the west coast. The quantity raised in 1903 was 1,065,000 pounds. The total annual production has recently been estimated (1916) at from 250,000 to 300,000 pounds, when, judging by the quantity manufactured, it should be five times this. Due to the high duties on imported tobacco and its products, the domestic leaf is largely used in the local factories, although a very large quantity is imported from Honduras, which is incorporated with the native leaf in the manufacture of cigars and cigarettes for export. Rapid progress has been made during recent years in the manufacturing of tobacco, both as to the quantity worked and the methods employed. While the small factory predominates, there being hundreds of shops producing hundreds of thousands of fine and ordinary cigarettes, there are also four machine-made factories in the country, producing an aggregate of 640,000 cigarettes per day. To protect the small shop, the government on 23 Nov. 1916 issued a notice requiring the payment of a tax of one centavo on each box of machine-made cigarettes. All domestic cigars are made by hand, the industry being an important one. Guatemala and Honduras tobacco are generally used, with a Sumatra wrapper bought in the United States. Most of the ordinary cigars are made by Indian women and children, whose labor is cheap, some of the cigars selling as low as $2 per thousand; those of better quality sell for from $0.02½ to $0.05 each. The cheapest machine-made cigarettes sell for about $1 per thousand. The domestic consumption of both cigars and cigarettes is large.

In 1915 Guatemala imported leaf tobacco to the value of $2,575; manufactured, $10,398. Of the leaf tobacco, $2,205 worth came from the United States, the remainder from Holland. Of the tobacco manufactures, the United States supplied $4,265; Cuba, $3,262; Germany, $950; Mexico, $760; England, $827; Jamaica, $163, and the remainder from Holland, France, Japan and China. As showing the consumption of cigarettes in the country, the imports of cigarette paper for 1915 amounted to $29,666, of which Spain supplied $26,311 worth; the United States, $1,637; the remainder coming from Germany, England and Denmark. During the same year exports amounting to $18,954 were made to the United States, Colombia, Honduras and British Honduras. Of this, $13,054 was manufactures, and $5,900 leaf tobacco.

Honduras.— Statistics regarding the production of and trade in tobacco in Honduras are lacking, but from the reports of the United States consular agents in that country and Guatemala, it is apparent that tobacco of a commercially fine quality grows in the country, but that through poor methods of curing it has not generally become an article of world export, but is sufficient for domestic needs. A large quantity is shipped to Guatemala, where it is manufactured, some of it being returned and some re-exported, and Peru. In 1913–14 there were imported tobacco and tobacco manufactures to the value of $17,146, of which the United States contributed $10,386; 1914–15, $20,520, of which the United States contributed $13,436.

Mexico.— The revenues derived from the profits of the tobacco monopoly in Mexico amounted, in 1783, to $777,651; and in 1801–02, to $4,000,000 silver, the monopoly of the tobacco industry having been a prerogative of the Crown from the time of the Spanish conquest. With independence, the industry languished until 1868, from which time it has gradually increased. In 1889, Mexican tobacco obtained the gold, silver and bronze medals at the Paris Exposition, being adjudged superior to the best Cuban leaf. Later, the French government gave official notice through «la Regie,» the special department concerned with the monopoly, that Mexican tobacco was acceptable for its uses.

In Mexico the use of tobacco is universal, and its consumption large, with the result that large quantities are raised of which no estimates are given. Being of universal use, it is grown everywhere. Experts credit the district of San Andres Tuxla, in the state of Vera Cruz, with the leaf of the choicest quality. The soil here is similar to that of the Vuelta Abajo in Cuba. In the Tuxla section, however, the same care has not been shown in the cultivation and handling of the leaf, for which reason it has failed of general commercial demand. Despite the fact of cheap and unscientific labor and methods, Mexican tobacco for years has been an article of export in the markets of the United States and Europe. Until the war in Europe and domestic political dissensions, the chief European markets were Hamburg and Havre, with a growing demand in England. At Hamburg, the Valle Nacional leaf, selected, grown by government convict labor, sold for $0.18 per pound, at which figure it was in great demand.

Recent figures as to the yield and export are not obtainable. In 1906, the estimated crop of the chief tobacco districts amounted to 26,180,000 pounds, divided among the following districts: San Andres Tuxla, 3,300,000 pounds; Acayucan Talixpam, 759,000 pounds: Cordoba, 7,700,000 pounds; Tlapacoyan, 3,795,000 pounds; Tepec, 3,795,000 pounds; Ojitlan, Valle Nacional, 3,530,000 pounds; Playa Vicente, 3,530,000 pounds; other districts of Oaxaca and Chiapas, 1,265,000 pounds, and districts of San Luis Potosi, 506,000 pounds. The foregoing was but a small part of the crop for the year, as figures are not given for the remainder of the republic. Luring the fiscal year ending 1911, the exports of tobacco (leaf and manufactured) to the United States amounted to $14,011; 1912, $31,039; 1913, $43,331; 1914, $58,941; 1915, $77,003, and 1916, $142,383.

Peru.— The tobacco industry in Peru is a government monopoly, the special department having charge of same being known as the Estanco del Tobaco, founded in 1904. Since 1909 it has been administered by the Compañia Recaudadora de Impuestos (National Tax Collecting Company) under contract for a term of years. The territory devoted to the cultivation of tobacco is designated by law, and the importation, manufacture and sale of all forms of tobacco are in the hands of this company. In addition to this control, the government is otherwise encouraging the tobacco industry. In the latter part of 1916, the government issued an order through the Department of Fomento (National Industry) commissioning two Peruvian graduate students to spend a year in Cuba to study the practical cultivation and handling of tobacco, to the end of introducing the approved scientific methods of carrying on industry in Peru.

The prices for tobaccos of all kinds are fixed by the government. The greatest and best quality of leaf is grown in the provinces of Huancavelica and Tumbes, the former supplying the government in 1915 with 619,490 pounds, and the latter with 421,600 pounds. In addition there was imported from Ecuador 596,445 pounds and 82,895 pounds from Honduras. In 1914, the quantity of domestic leaf used was 798,659 pounds, there being imported in addition 65,714 pounds from Ecuador and 101,707 pounds from Honduras. Of cigarettes, the domestic manufacture in 1914 amounted to 404,429,700; cigars, 175,400. In 1915 the respective numbers were 369,299,052 and 152,100. The average cost of the domestic cigarettes was $0.74 per thousand. During 1914, there were imported 38,825,232 cigarettes; 1915 (estimated), 8,800,000; cigars, 1914, 245,814; 1915, 31,099, the great bulk of each coming from Cuba, most of the remainder from England.

Venezuela.— The production of tobacco for domestic consumption is carried on throughout Venezuela, in addition to which an export of more than 200,000 pounds is made annually, the greater part, until the European War, to Germany. The tobacco of Capadare, a special district, is noted for its strength and aroma, and by some is preferred to Habana tobacco. Besides Capadare, tobaccos of excellent quality are raised in the districts of Yaritagua, Mérida, Cumanacoa, Guanape, Maturin, Upata, Aragua, Carabobo, Barinas, Rio Negro, Caripe and the Federal district. The greater part used in the country is of domestic manufacture, Cuban and Virginia leaf being imported for blending. The imports of leaf and manufactured tobacco in 1914 amounted to $10,912; 1915, $3,643.

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18. WOOL INDUSTRY IN LATIN AMERICA. The wool industry is subject to climatic influences, it being found that, while sheep thrive in the tropic and semi-tropic zones, nature, by its law of compensation, relieves them of the necessity of clothing themselves to withstand the cold and their wool loses those qualities that the requirements of commerce have standardized. Applying this to Latin America, we find that the most successful exploitation of the wool industry is in the extreme southern countries of South America, or on the high table lands free from tropic influence.

Argentina.— Next to Australia, and on a par with the United States, Argentina occupies a pre-eminent position in the wool industry. Unlike the cattle and meat industry, wool growing has been of long standing. In 1885 the exports of this commodity amounted to $35,950,111; 1890, $35,521,681; 1900, $31,029,522; 1905, $27,991,561; 1910, $58,847,699. The best year during this period was 1899, during which the total amounted to $71,283,619. Throughout the entire statistics of the country, a fact generally true elsewhere, a close relation is noted between the production of wool and the price of mutton. When the latter is in demand at a good price, entire flocks of sheep are slaughtered, with a resulting diminution of the wool clip for the following few years.

On 1 Jan. 1915, the estimated number of sheep in the republic was 80,000,000, and the estimated clip amounted to upward of 300,000,000 pounds per annum (*Commerce Reports*, 1 Dec. 1916). Sheep are pastured throughout the republic, particularly in the central and southern part. Requiring cheap lands, they have been pushed further south each year, with the result that parts of Patagonia and of Tierra del Fuego, considered a generation ago as uninhabitable for civilized man, have been found to be peculiarly adapted to the industry. The rapid development of this territory to its new capabilities, in connection with a similar development in the corresponding latitude of Chile, has made a distinct sheep-raising section of the southernmost part of the continent, tributary to a great extent to Punta Arenas, Chile, which until recently was a free port.

Vice-Consul J. W. White, at Buenos Aires, on 17 Oct. 1916 made an extended report on the wool industry to Washington, calling attention to the conditions permitting Argentina to demand unheard-of prices for her wool. The action of the British government in placing an embargo on the sale of the previous year's clip of the United Kingdom had operated to the direct advantage of the republic, enabling her to supply the wants of neutral countries in addition to filing orders from the Entente Allies for such varieties as the British colonies do not produce.

Seventy-five per cent of the wool comes from the white-faced, long-wool sheep of the Lincoln and Leicester breeds, the quantity and the quality being such that in the markets of the world it is known as Argentine crossbreed. Its grades, when sorted into coarse and medium crossbred, correspond to the domestic commons and domestic one-fourth bloods in the United States. The fine Argentine crossbred is the equivalent of the United States three-eighths blood. Of the yearly total, merino fleeces constitute 20 per cent, the equivalent of the domestic fine in the United States, and the remaining 5 per cent is from the black-faced and domestic sheep. The average clip per animal is 5.3 pounds.

Prior to the European War, the principal buyers of Argentine wool were France and Germany. Exports to France in 1911 amounted to 51,501 tons; 1912, 51,138 tons; 1913, 31,342 tons; and 1914, 23,794 tons, a total for the four years of 157,775 tons. During the same period, Germany bought in 1911, 31,693 tons; 1912, 47,839 tons; 1913, 41,362 tons; and 1914, 30,386 tons, total, 151,280 tons. During the same years the purchases of the United Kingdom amounted to 93,225 tons; Belgium, 55,731 tons; United States, 42,521 tons; Italy, 14,849 tons; and other countries, 18,989 tons. From these figures the total exports of wool for these four years totaled 534,370 tons, being divided as follows: 1911, 132,056 tons; 1912, 164,964 tons; 1913, 120,080 tons; and 1914, 117,270 tons. Recent economic changes have made the United States the principal purchaser of Argentine wool. Of the total export, 298,939 bales (925.9 pounds each) for the fiscal year ending 30 Sept. 1916, 152,330 bales went to the United States, as compared with the 102,429 bales purchased of the export of 303,402 bales in 1915, and 34,000 bales out of 304,268 bales in 1914. The strong demand from the United States contributed largely to the increase of prices, the average sales in 1912 being, per pound, $0.165; 1913, $0.175; 1914, $0.175; and 1915, $0.201. During the August-September market season of 1916, the foreign demand plus speculation forced the price from $0.327 to $0.404 per pound, quotation that covered all classes, including lambs' wool, shorts, belly wool and sweepings, the spirit of speculation being so strongly instilled into the market that to-day no settled price is recognized.

Chile.— In Chile the raising of sheep for their wool to be used in the domestic textile industry has been carried on since the first settlement of the country. It is within the present generation that the industry has assumed export proportions, a result of the development of the southern portion of the republic, including the extensive territory of Magellanes. The number of sheep in the country, according to the estimate of the government (*Commerce Reports*, 16 March 1916), is 5,000,000, of which 2,000,000 are in the territory tributary to Punta Arenas.

Formerly the centre of the government penal colony, founded in 1840, Punta Arenas, on the Strait of Magellan, in time became an important coaling station for steamers. Later, Scotch shepherds from the Falkland Islands, noting the excellence of the pastures in the vicinity, brought their flocks and started the industry that promises to become one of the most important in the country. The result has been that the Chilean government has recognized the possibilities of this part of the republic, and has thrown open the territories of Llanquihue, Chiloe and Magellanes to settlement, and thousands of acres of land have been occupied, the greater part devoted to sheep farming. There are many settlers from the British Isles, and English is everywhere spoken. Punta Arenas, population 17,000, was a free port until 1912, one cause of its rapid growth and importance. The territory, all devoted to the same industry, of which it is the chief city, includes not only Chilean pastures, but those of southern Argentina. The estimated clip for 1916 (*Commerce Reports*, 21 Oct. 1916), was 25,000,000 pounds. Argentine wool also to the amount of 1,347 metric tons (2,204.6 pounds) passed through this port in 1914.

In 1913 and 1914 Chile exported the following amounts (metric tons): To Great Britain, 9,400 and 8,115; France, 1,938 and 1,264; Belgium, 583 and 39; Germany, 742 and 2,185; and the United States, 7 and 358. Due to the demand caused by the war, exports increased greatly to the United States, those for 1915 (fiscal year ending 30 June) amounting to 2,369,359 pounds, valued at $599,650, and 1916, 9,611,489 pounds valued at $2,562,792.

Chilean wool is divided into two general classes — merino, which is fine, soft, curly and comparatively short, and English, which is long, straight and glossy. Between these two grades there are various "crossbreeds," the quantity of these increasing each year. After 1914, the price of merino wool fell, while the crossbred rose appreciably. Export wool is unwashed (*Commerce Reports*, 16 March 1916), weighing twice as much as that prepared for spinning. The lack of facilities for washing had the effect of causing difficulty in the dyeing of wools for native industry. Of this latter there are two factories in the country, at Santiago and at Tome, the annual consumption being about 550 metric tons of wool, and their output 435,000 yards of fabric, which is used in part for army, navy and police uniforms. In addition, the manufacture includes cashmeres, broadcloths, blankets and shawls.

Uruguay.— Uruguay, as regards the production of wool, is subject to the general conditions that affect Argentina. The country is essentially pastoral, and the greatest interest has been taken by the government in the introduction and propagation of fine stock. The exports of wool in 1913 amounted to 63,571 metric tons. Since 1914, the greatest trade in this commodity has been with the United States, the exports in 1914 (fiscal year ending 30 June) amounting to 7,965,817 pounds, valued at $1,854,065; 1915, 14,612,703 pounds, valued at $3,956,216; and 1916, 8,941,506 pounds, valued at $3,206,191.

Brazil.— Brazil, due to the tropical nature of the greater part of its surface, is not destined to become one of the great wool producing countries. However, in the southern part of the republic — notably in the state of Rio Grande do Sul — the climate is adapted for sheep raising, and a considerable quantity of wool is produced. The principal market of the country for wool is at the port of Rio Grande. Success is also reported in sheep raising for wool in the states of Paraná and Minas Geraes. Exports for the country in 1911 amounted to 2,147,970 pounds, valued at $311,386; 1912, 4,198,630 pounds, valued at $571,276; 1913, 2,838,804 pounds, valued at $394,155; 1914, 2,448,193 pounds, valued at $251,544; and 1915, 997,639 pounds, valued at $193,065. Exports to the United States during the fiscal year ending 30 June 1915 amounted to 115,147 pounds, valued at $29,389; and 1916, 87,864 pounds, valued at $15,590. Native industry consumes a large amount, the quantity increasing rapidly.

Other Countries of Latin America.— Of the Latin-American countries, there are none that do not produce some wool, many in large quantities, and some a product of a special quality, this latter being particularly true of Peru, Bolivia and Chile, where, in the Andes region, the alpaca, vicuña and llama thrive. In the supplement to *Commerce Reports* of 18 April 1917, the United States Minister at La Paz says: "Throughout the arid region that lies between the two Cordilleras a species of bunch grass grows which is capable of resisting the rigors of winter and which provides abundant pasture for sheep and other wool-bearing animals. Experiments conducted under government supervision seem to indicate that the alpaca is better suited to live in the highlands than is the sheep or any other wool-bearing animal. The government of Bolivia is making a special effort to stimulate the industry, and the production of alpaca wool is attaining considerable importance in the country." (Samples of alpaca and llama wool, raw and woven into native fabrics, may be seen at the Bolivian Consulate-General at New York).

Four animals closely related to the camel of Africa and Asia inhabit the Andean highlands. Of these the vicuña and guanaco are wild and hold no important position as a source of wealth. The skin of these animals is covered with a coat of soft hair and has value as a fur. Efforts to prevent their extermination, however, are of little effect in a country so sparsely settled and so difficult to police, and the fear is that they may eventually disappear altogether. The alpaca and the llama are domesticated . . . The alpaca, although closely related to the llama, with which it interbreeds freely, differs . . . in the character of its wool. The wool of the alpaca is generally black or white; occasionally, however, brown or spotted ones are found. It is customary to shear the alpaca every second year, but it has been found that the wool continues to grow for a longer period and that it would be profitable to shear them only every third year. The present yield averages about 10 to 15 pounds every second year . . . Among the wools alpaca is superior because of its remarkable strength, its flexibility, and the fineness of its texture . . . The production is limited entirely to the Andean highlands of Peru and Bolivia.

Peru, in addition to her production of alpaca and llama wool, has large domestic sheep interests. The exports of alpaca wool in 1913 amounted to $1,573,670; 1914, $1,538,427; and 1916, $1,696,213. Of llama wool, the exports in 1913 amounted to $141,493; 1914, $90,477; and 1915, $144,152. Domestic wool, $797,868; 1914, $841,165; and 1915, $1,066,844. Exports to the United States in 1915 (fiscal year ending 30 June) amounted to 819,347 pounds, valued at $192,284; and 1916, 2,426,279 pounds, valued at $669,174.

Colombia, although using a considerable quantity of wool in domestic manufacture, also produces some for export. The quantity sent to the United States in 1915 amounted to 915 pounds, valued at $218. No shipments were made in 1916. Paraguay also produces wool for export, the quantity sold abroad in 1914 being 93,634 pounds; and 1915, 129,127 pounds. Of this latter, 24,651 pounds were shipped to the United States, the remainder to Argentina, Uruguay, Italy and France. As to Venezuela, no figures regarding wool production are available. Of the northern group of Latin-American states, Mexico is the greatest grower of wool. In normal times it is an important industry. Even during the recent troubled perod, her exports to the United States amounted in 1914 (fiscal year ending 30 June) to 849,991 pounds, valued at $108,004; 1915, 1,154,626 pounds, value at $134,863; and 1916, 1,321,213 pounds, valued at $170,518. Of the remainder of the group, the only states exporting to the United States during 1916 (fiscal year ending 30 June) were Costa Rica, 19,574 pounds, valued at $8,935; Guatemala, 572 pounds, valued at $257; and Panama, 200 pounds, valued at $50.

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LATIN CHURCH. See Catholic Church, Roman.

LATIN CROSS (*crux immisa* or *capita*), cross with the upright considerably longer than the transverse beam which crosses it near the top. It is generally regarded as the type used in the crucifixion of Christ and therefore becomes a symbol of the Christian faith.

LATIN EMPIRE. See Byzantine Empire.

LATIN HYMNS. See Hymns, Latin.

LATIN KINGDOM OF JERUSALEM, kingdom established and maintained by the Crusaders in Jerusalem in 1099–1187, and afterward re-established around Saint-Jean d'Acre and maintained until 1291. The kingdom was the common property of Christendom and during its two centuries of existence its character was international. The French, however, were strongest among the ruling officials, while the Italians attained a considerable economic influence. The kingdom reached its greatest dimensions toward the middle of the 12th century when it extended on the Syrian coast from Beirut to Raphia, from the Lebanon district on the northeast to beyond the Dead Sea on the southeast, extending along the Jordan to the Arabian Desert and including the port of Aïla on the Red Sea. The kingdom was organized on the feudal system and the sovereignty was vested in the body of feudatories who composed the high court rather than in the king whose authority was chiefly military. The court's authority governed the succession to the throne, made the laws and constituted the high tribunal from whose decisions there was no appeal. The «Assizes of Jerusalem» was compiled by the court. Later in the 12th century a court of burgesses was organized, this having power over the burgesses, sentence of either exile or death being vested in it, a power withheld from the king and at first non-existent in the kingdom. The great feudal chiefs, however, really maintained inedpendent kingdoms within the limits of the greater kingdom, and on occasion even waged war without consent of the king. However, the royal authority had ample financial resources, derived from customs, caravan taxes and the monopoly of special industries. The right to coin money was vested within the king's authority, and with the consent of the high court he could levy additional taxes in case of threatened invasion. On the occasion of Saladin's arming against the kingdom in 1182 a tax of 2 per cent was levied on all revenues, even those of the Church. The vassals owed military service but received payment for it. Godfrey de Bouillon was elected Lord of Jerusalem, 22 July 1099, but did not assume the crown. He was succeeded by his brother, Baldwin of Odessa, who was crowned king of Jerusalem, 25 Dec. 1100. Baldwin I (q.v.) reigned until 1118 and was the real founder of the kingdom, greatly extending its territory and effectively organizing its power. He was succeeded by his son Baldwin II, 1118–31, who was followed by his son-in-law, Fulk, Count de Anjou. He also succeeded in increasing the importance of the kingdom, reigning in 1131–41, and succeeded by his son, Baldwin III, 1143–62, under whom the kingdom reached its zenith, although the principality of Edessa was wrested from it in 1144. He was succeeded by his brother Amaury I, 1162–74, who aroused Saladin by his attempted subjugation of Egypt. His son Baldwin IV, 1174–85, ruled through a regent, owing to his illness from leprosy, and was succeeded by a nephew, Baldwin V, a child who was supposed to have been poisoned a year later. Dissensions among the barons had by this time weakened the royal power and Jerusalem fell to Saladin in 1187 under the reign of Guy de Lusignan and his wife, Sibylla, mother of Baldwin V. The siege of Saint-Jean d'Acre was then begun and upon its surrender, 13 July 1191, the kingdom of Jerusalem was re-established there. It continued in existence until 1291, Jerusalem itself being within its jurisdiction in 1229–44.

LATIN LANGUAGE, The. One of the Indo-European family of languages, spoken in Latium and especially in Rome; and extended with the Roman rule over the ancient world; the source from which the Romance languages (Italian, French, Spanish, Portuguese) are derived.

As one of the Indo-European languages Latin shows a relationship in vocabulary, in inflected forms and in syntactical structure to other branches, Greek, Sanskrit, Germanic, Slavic, but according to the theory now generally accepted this indicates linguistic relationship only and does not necessarily imply an ethnological connection between the races speaking these languages. It was long held that the resemblance between the Greek and the Latin was so close as to warrant the belief that the two languages (and races) were derived from a common stock, but this theory (of a Græco-Italian unity) is now generally abandoned. Probably the closest connection of Latin is with the Celtic languages.

Latin was one of a group of dialects spoken in central Italy. The other best known and most closely related Italic dialects are the Faliscan (which is scarcely more than a local variety of Latin) and the Osco-Umbrian. The latter was an extensive family of dialects spoken in the mountain districts of central Italy, especially in Samnium, and in early times was more widely distributed than the Latin and of at least equal advancement. The Oscan is represented by a number of inscriptions, of which the *Tabula Bantina* is the longest, and the Umbrian by the Iguvinian Tables, of some 4,000 words in length.

The Latin language was reduced to writing at an early period by the use of an alphabet derived from the Greek alphabet of the town of Cumæ. Of this earliest period we have scanty records in inscriptions from about 500 B.C. down (the Fibula of Palestrina, the Duenos inscription) and in the rituals of the Salii and the Arval Brethren. These were not wholly intelligible to the Romans of the classical times and are still in part obscure; but enough is clear to show that the language was at that period a raw dialect of limited vocabulary, incapable as yet of expressing the thoughts or emotions of a highly civilized people.

The change from a rustic dialect to a literary language took place in the 3d and 2d centuries B.C. It was brought about by two causes. In the first place, through the extension of Roman power over the whole of Italy, Latin became the language of trade and of official intercourse throughout the peninsula; in this process of expansion the language reflected the expanding interests and necessities of the people who spoke it, becoming by use richer in vocabulary, more varied and at the same time more regular in structure, and gaining by its contact with the Oscan and Umbrian. This process was aided also by the constant practice of oratory, which the workings of a free constitution called forth. In the second place, the contact with the Greeks of southern Italy gave an immense and lasting stimulus to literary production. At first this took the form of the drama and the epic, and the necessities of verse, particularly of the Greek hexameter, required a conventional distinction between long syllables and short, such as the native rhythms, which were mainly accentual, had not required. The quantitive character thus given to the language and the imaginative enrichment which came from its employment in poetry affected chiefly the language of literature. On the other hand, in the spoken Latin, the giving up of the Indo-European accentuation and the adoption of a new accent-law, by which the main accent was restricted to the penult and ante-penult, resulted in the frequent shortening of the unaccented final syllable, especially in iambic words, and in the occasional dropping of final consonants.· Acting in different directions, as a conservative force in the literary Latin, as a cause of rapid change in the spoken language, these influences produced the beginning of that separation between the language of books and the speech of the common people, which, though it occurs to some degree in all languages, is a most marked peculiarity in the development of the Latin language.

For about a century and a half before the beginning of our era and for an equal time after that date the Latin of books remained almost unchanged in sounds and forms; its history during this time deals with its growth and change as an instrument of literature. The Classical Period (the Ciceronian and Augustan) saw the culmination of Latin style, first in prose and then in poetry. Cicero was an extraordinary master of style and in his hands the language lost its archaic stiffness of structure and became a flexible and a complex means of expression. Better than any other Latin writer he used the periodic form of sentence, not as a mere rhetorical device, but as a suitable expression for a complete thought, with all its subordinations and interdependence, in a unified and harmonious structure. Cæsar also represents the simplest narrative prose, free from archaisms and absolutely unaffected and unadorned. In verse Virgil and Horace are types of the artistic use of imaginative speech, in which by a careful felicity of selection and combination language is made to convey poetic suggestion, without either the affectation of the Alexandrian school or the heaviness of Ennius or Lucretius.

The change from the Classical Period to the «Silver» Latin of the early empire is likewise chiefly stylistic and from this point of view it must be regarded as a change for the worse. To a considerable extent pleasure in the mere arts and tricks of expression took the place in Ovid and Martial of true poetic force and poetry became contaminated by rhetoric. In prose, however, the rhetorical and individualistic tendencies were less injurious; Tacitus, though he abandoned the periodic structure of Cicero and introduced into prose many words from the vocabulary of poetry, nevertheless used a style suited to his temperament and subject.

It is not worth while to follow in detail the later history of the literary Latin. It was in the main rhetorical and imitative and it lacked that vigor of thought which alone can maintain a vigorous linguistic life. To this general statement there are two exceptions. The Latin of the jurists kept up the tradition of accuracy and clearness, employing a technical vocabulary without rhetorical artifice, and the Christian writers, possessed by the supreme desire to convey a serious message to unlettered readers, continued the spirit, if not the form, of the better Latinity. With these exceptions, however, the Latin of literature is, after the 2d or 3d century, no longer in the fullest sense a living language.

Meanwhile the Latin of daily life, the language spoken by the common people of Rome, by slaves and provincials and soldiers, had continued to exist under the level of the literary language, from which it was separated about 250 B.C. The evidence for the spoken Latin during the later republic and the early empire is somewhat scanty, consisting of occasional inscriptions like the wall-writings of Pompeii or passages in authors like Petronius, in which the colloquial Latin is intentionally imitated. But the effect of the accent in the shortening of final syllables is to be seen even in Horace and Virgil and this tendency leads in some inscriptions to the loss of final consonants. After the 3d century of our era we have increasing evidence of change in sounds and forms. The vowel *e* and the diphthongs *æ*, *œ* were no longer clearly distinguished in sound, and were therefore confused in writing; *au* became *o*; *b* and *v* were interchanged; the softening of *c*, *t* and *g* before *e* and *i* began; initial *h* was lost or was misplaced (this had begun in the time of Catullus). Still more marked was the loss of the distinction, probably never made with great precision in the ordinary speech, between long and short vowels, and the consequent reappearance of accentual verse. The disappearance of final consonants, especially *m* and *s*, destroyed the distinctive marks of gender and even of case, so that cases, being no longer distinct in form, were not clearly differentiated in usage. In syntax the older paratactic constructions, which are found in Plautus and occasionally throughout Latin literature, again appear and analytic idioms (*habere* as an auxiliary verb) began to displace the inflectional verb-forms; the use of prepositions weakened the force of the cases; conjunctions lost their original meaning, *quod*, for example, driving out other conjunctions. All these are steps toward the passage from Latin to the Romance languages. They went on at different rates in different parts of the empire and under different conditions, but the beginning of many can be traced back to early Latin and they are not to be thought of as accidents by which the Latin language was destroyed, but as entirely normal and natural changes which mark the progress of the language from the inflected stage to the comparatively uninflected condition of the Romance languages. From this point of view the Latin of literature is to be regarded as a deviation, in some sense artificial, from the normal life of the language. See ALPHABET.

Bibliography.— There is a good sketch of the history of the Latin language in the ‘Historische Grammatik der latinische Sprache’ (I, 1) by Stolz, and a longer history and discussion by Weise, ‘Charakteristik der lateinische Sprache.’

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LATIN LITERATURE. Within the brief limits of the following sketch it will not be possible to describe fully the characteristics of single writers (for these special articles must be consulted); only a general history of Latin literature will be given, with a summary estimate of its value.

A division into periods will be found convenient, though such divisions in a continuous development must not be understood to imply abrupt changes.

1. The Prehistoric Period down to 240 B.C.— No complete writings from this period survive in their original form, but from fragments and chance allusions it is known to have been a period of native beginnings, as yet untouched by foreign influences. In poetry, which from its nature takes literary form before prose, we possess partly modernized fragments of religious ritual in verse, the forerunners of a kind of lyric. A few allusions seem to indicate the existence of the custom of chanting lays in honor of national or family heroes, which might under favoring conditions have flowed together into an epic, and many references and some later fragments show that village festivals, in Italy as in Greece, were celebrated with songs and dances of a mimetic and humorous character, out of which a subordinate kind of drama actually arose, even after the introduction of Greek comedy. Semi-ritualistic charms and farmers' maxims, of which Cato gives us specimens, might easily have been collected into a didactic poem on agriculture. In prose the legal codifications were already well advanced, and the many forms of official record furnished the material for history and, indeed, dictated its earliest annalistic form. Oratory, as might be expected, was in constant use in the Senate, in popular assemblies, and for purposes of eulogy, and a speech of Appius Claudius Cæcus, delivered in the Senate in 280 B.C., was still extant in the time of Cicero. Thus in several directions the germs of a native literature had appeared before the Greek influence was felt.

2. The Period of Greek Influence, Beginning with 240 B.C. and Lasting for about a Century.— Through the conquest of the Greek cities of southern Italy the Romans first became fully aware of the treasures of Greek literature, by that time practically complete. Its introduction into Roman life was due to a Greek slave, Livius Andronicus, who translated plays of the Greek «New Comedy» (Meander and others) for presentation at the Roman festivals and put the 'Odyssey' into Saturnian verse to be used as a reading-book in schools. He thus gave a new impulse and direction both to dramatic and to epic poetry and he was followed in the drama by native Italians, Naevius, Plautus and Ennius, and in the epic by Naevius, who wrote a history of the First Punic War in the native accentual verse-form. Ennius, the most influential writer of the period, continued the epic still further by writing in hexameters a history of the Roman race, which remained the national epic until the appearance of the 'Æneid.' Other dramatic writers followed, the tragedy being less original and less popular than the comedy. Ennius also gave literary form to satire, a peculiarly Italian product, written by him in various metres and on a variety of subjects and put into final form at a later period. The prose of this time was still mainly of a practical character. Cato the Censor wrote out and published many of his speeches for use as political pamphlets, composed a book of maxims drawn from his active life for the benefit of his son, some at least being in the form of letters, and wrote a treatise on farming which, in a partially modernized form, is still extant. The writing of history had already begun, in the Roman annalistic form, though in the Greek language, but Cato wrote a history of Italian towns in Latin. There was also considerable activity in legal writing, though systems of jurisprudence came somewhat later. This last was purely Roman and in general the Greek influence was less felt in prose, and the impulse to stylistic finish was less active than in poetry.

The period was thus one of beginnings in many lines. The stimulus of the Greek literature was almost a tyranny as to the form, especially in poetry, but in the writers of more original mind the Italian spirit and something of the Italian form, like the music and dances of comedy, still maintained itself. In the period of transition to Cicero's time (about 150-84 B.C.) the further growth of oratory, history and jurisprudence in prose, and the writing of plays on Italian subjects and in native form, showed that the Latin spirit was recovering from the first dominance of the Greek artistic form. In particular, it was during this time that the purely national satire received its permanent form and direction at the hands of Lucilius.

3. The Ciceronian Age, 83-43 B.C.— In this period, which is defined by the beginning and the end of Cicero's literary activity, Latin prose reached its culminating point, combining at last into a harmonious whole the earnestness of the Roman and something of Greek artistic skill. The practical national tendencies were still exemplified by Varro, who gave a long life to investigation and published works in many fields, in law, history, philosophy, grammar and agriculture, with an almost exclusive attention to the matter rather than to the style. In history Sallust may be called the first of Roman historians, in the true sense of the word as distinguished from the annalists and antiquarians, but his style is intentionally archaic and not wholly natural. The period was especially rich also in political writings, in the form of biographies and memoirs, among which must be included the commentaries of Cæsar, historical in form, but written for a political purpose, and models of perfectly simple narrative in the purest diction. But the chief figure in the literature of the period was Cicero. He was a man of wide knowledge both of the earlier Roman oratory and of Greek rhetoric; he was equally interested in the theory and in the practice of public speaking, and his warmth of temperament and purity of taste in composition made him an eminent master of style. His writings have remained since his time the models and standard of Latin prose. Aside from his speeches, of which some 50 are extant, he left valuable works on rhetoric, some well-written treatises on philosophy and a large and extremely interesting collection of letters, gathered and published after his death by his secretary.

In poetry also this period was second only to the Augustan Age. Lucretius, continuing the tradition of didactic poetry, wrote in hexameters an exposition of the atomic theory of Epicurus. The subject was in itself unsuited to poetry, but Lucretius has so infused into it his own moral earnestness and so interspersed and adorned the doctrines with passages of lofty beauty that the work is intensely Roman and is undoubtedly the greatest didactic poem in existence. In lyric poetry Catullus left behind him at his early death a few score of poems, almost all quite short and some of them overwrought with imagery and allusion in the Alexandrian manner, but of the purest lyric strain and in this one respect superior to the ‘Odes’ of Horace. If the fame of Catullus rested on the ‘Attis’ alone he would be called a great poet.

4. The Augustan Age, 43 B.C. to 14 A.D. This period was, in contrast to the preceding, mainly an age of poetry. The loss of political freedom affected unfavorably both the public oratory and the political and historical prose. Scarcely an orator of the period has left more than an empty name and public speaking sank into declamation and rhetorical display. In history there is the one great name of Livy, but even he, though a friend of Augustus, found in the history of the past a kind of refuge from the political hopelessness of his own time. His style, in the narrower sense, was an adaptation of the periodic sentence structure of Cicero to the purpose of narrative, to which it is not entirely suited, but his descriptions — his “pictured page” — are wonderfully vivid. From him and from Plutarch's ‘Lives’ most of our popular conceptions of Roman history and character are derived.

But the conditions which were unfavorable to the highest kinds of prose composition fostered production in the unemotional and impersonal fields of technical writing. To this period belong the work of Vitruvius on architecture, the extremely learned work of Verrius Flaccus on lexicography and grammar, now unfortunately lost, and some important writers on law. It was, however, in poetry of high quality that the age was especially productive. Virgil, after some imitations of Theocritus and a very perfectly finished poem on farming, left behind him at his death the ‘Æneid’ in almost complete form, to become at once the great epic of Rome and in later times the most widely known of Latin poems. Horace, a Republican in his youth, who had fought at Pharsalus, continued the tradition of satire after the manner of Lucilius and wrote the four books of the ‘Odes,’ inferior to the poems of Catullus in lyric feeling, but superior in their attitude toward life and perhaps in their close stylistic texture. He also became at once a classic and has been the favorite poet of many men of society and of affairs. Tibullus and Propertius introduced elegiac poetry and seem in this field to have surpassed their Greek models. Ovid wrote a long poem embodying Greek myths, an account of the festivals of the Roman calendar and a number of minor poems, all with an unrivaled technical skill; but he was a man of weak fibre and lacking in genuineness and his personal failings have lowered the tone of his writings.

Taken all together, this roll of names, though no one of them is quite of the very highest rank, entitles the Augustan Age to a place among the great periods of literary production.

The Ciceronian and Augustan periods are sometimes put together and called the Classical Period, or, in contrast with that which follows, the Golden Age of Latin Literature.

5. The Silver Latin, 14–117 A.D.— Two characteristics mark the literature of the early empire. On the one hand, technical skill in the craft of writing was never greater nor more generally exercised. Verse-composition was common and the versification was accurate and finished. But, on the other hand, the increasing tyrannies of Tiberius, Caligula, Nero and Domitian suppressed independence of utterance and even of thought and the decrease in race-vigor weakened the nobler impulses to expression. Technical skill was therefore put to frivolous or ignoble uses and was directed by petty vanities into mere affectation, instead of being controlled by a reserved taste and a sober purpose. Poetry borrowed the rhetorical devices of prose and prose used the vocabulary of poetry.

But while this description is fairly applicable to most of the writers of this and the succeeding period, there were not a few writers who, though they were inevitably affected by the character of their times, were yet raised by interest in their subject or by refinement of taste almost to the level of the Classical Period. This was true in a measure of many of the writers on technical subjects, grammar, agriculture, medicine, law; such, for example, was the elder Pliny, who collected a sort of compendium of knowledge in his ‘Naturalis Historia.’ The philosopher and poet Seneca has been at times highly esteemed, but it is difficult to acquit him of insincerity and his closet-dramas betray his tendency to bombast. Quintilian, however, was a great teacher of rhetoric in the best sense and a writer of learning and taste, who would have been distinguished in any age. With him may be ranked, though on different grounds, the younger Pliny; the collection of his letters was made by himself and the letters were doubtless written for publication, so that they lack (except the correspondence with the Emperor Trajan) the interest of Cicero's letters, but Pliny was a man of excellent taste and of creditable aspirations and his character as revealed in his correspondence is distinctly attractive. The greatest prose writer of the period was Tacitus, the historian. He had endured and been embittered by enduring the dreadful oppressions of Domitian's rule and under the liberal reign of Nerva and Trajan he used his opportunity to write truthful and independent histories of the empire. His style is individual and difficult from its condensation, but better suited to his subject than the Ciceronian periods would have been, and his treatment of his theme, though not free from prejudice, is extremely powerful. Herodotus and Thucydides in Greek and Livy and Tacitus in Latin are the four great historians of the ancient world.

On the side of poetry, though there were many writers of some merit, only a few deserve mention here. Martial composed epigrams, Lucian wrote an epic of the civil war between Cæsar and Pompey, and Persius and Juvenal were satirists. The latter is, in spite of rhetorical blemishes and a repellant savageness of tone, one of the greatest writers in Latin literature and his satire has been the model for much writing of the same kind in English literature.

6. The Later Empire.— Of writers after the end of the first century of our era few are of importance from the strictly literary point of view and there is a certain justice in closing the history of Latin literature with Tacitus. But in the long list of writers of the next four or five centuries there are many whose works have, apart from their form, an intrinsic interest, in some cases a very great interest. From them may be selected the following names: In history, Suetonius, Ammianus and the 'Scriptores Historiæ Augustæ'; in literary commentary and criticism, Gellius, Donatus, Servius and Macrobius; in grammar, Marius Victorinus and Priscian. The most original and perhaps in a true sense literary work of these centuries is to be found in the legal writings, from Gaius to the 'Code of Justinian,' and in the Church Fathers, Lactantius, Ambrosius, Jerome, Augustine and many others; in writers of both of these classes interest in the subject checked the prevalent inclination to regard the art of writing as an end in itself rather than as a means.

This chronological review of Roman literature may be supplemented by a brief summary and estimate of Latin writers by classes according to their form or subject matter. In the comparative simplicity of the ancient literatures the connection between writers in the same class was more direct and therefore more noteworthy than it is in modern times.

The Roman drama, having been early checked in its possible growth by the introduction of Greek models, took almost entirely a Græco-Roman form. Of the tragedies nothing has been preserved except the book-plays of Seneca, and the writing of tragedy for the stage had come to an end before the time of Cicero. The form of drama which took its subjects from Roman legend appears to have been only slightly successful and it is evident that the serious drama had little hold upon Roman life. The comedies, even those of Greek form like the extant plays of Plautus and Terence, expressed more of the Italian spirit and retained their hold upon the stage, and the farces, the mimes and the Atellan plays were even more popular. The Italian interest, then as now, was more in the acting and impersonation than in the dramatic form or story.

In epic poetry the glory of the Homeric poems was so great as to determine, somewhat to its disadvantage, the form of the Roman national epic. It is not unlikely that Ennius was in this respect more truly national than Virgil. The poet of the 'Æneid' was in truth hampered by the Homeric machinery of gods and heroes and by the supposed necessity of imitating in one part of his poem the wanderings of Odysseus, in another the battles of the Iliad. These things were not real to him; they were epic conventionalities which he felt obliged to adopt, as he adopted at times the phrases and the similes of the Homeric style. In all these respects, in which the 'Æneid' is most frequently and quite properly compared with the Greek epic, Virgil is plainly the inferior and they are sufficient to exclude him from the small company of the world's greatest poets. But in the occasional passages where he is inspired by the opportunity of expressing his real theme — the greatness of the Roman state — he writes with a proud dignity and a conscious understanding of the meaning of history, to which there is no parallel in the Homeric poems. His verse also is suited to the dignity of his thought; his hexameters are composed as wholes; while the Homeric hexameter appears to retain the traces of its composition out of two short half-verses. The Virgilian verse is less suited to the simplicity of narrative, but is unequalled in elevation.

Didactic writing in prose and verse was especially natural and attractive to the Roman mind and the series of didactic works extends from the earliest times down to the end. The most notable in verse are the great poem of Lucretius 'De Rerum Natura' and the 'Georgics' of Virgil. Both depend largely — Lucretius wholly — on Greek authorities for their subject matter, but two more thoroughly Roman poems could not be named. In form the work of Lucretius is incomplete; the 'Georgics' is one of the most perfectly finished poems in Latin literature.

Lyric poetry in Latin has an especial interest from the fact that the Greek lyrics of the best period are preserved only in fragments and our conception of this important form of poetry in ancient literature must be derived chiefly from Catullus and Horace. Apparently the best qualities of Alcæus and Sappho are better reproduced by the free spontaneity of Catullus than by the careful workmanship and mature intelligence of Horace. We are fortunate in the possession of both. Lucretius, Catullus, Virgil and Horace are the four cornerstones of Latin poetry.

The elegy is closely allied to the lyric, from which it differs chiefly in the use of the elegiac couplet, hexameter and pentameter. The examples that we have in Tibullus, Propertius and Ovid do not conform to the rule of ancient grammarians that elegy should deal with melancholy themes. But the somewhat despondent temperament of Tibullus and the simplicity of his treatment are well suited to elegy. Propertius is more virile, but is over-much given to the display of Alexandrian learning. In the amatory elegiacs of Ovid his extraordinary cleverness has a congenial field and his lack of essential manliness is less detrimental than elsewhere.

Epigram and satire were also natural forms of expression for the Italian, and many epigrams are extant in inscriptions or are preserved anonymously in the Anthology. Martial is the only writer whose collected epigrams have come down to us. They are often neat, often amusing, but this form of art is of course not very high. In satire the Romans claimed complete originality and apparently with justice. The satirical spirit may express itself in comedy or epigram or in semi-lyrical iambics like the 'Epodes' of Horace; but the grammarians meant that in Latin the satire had been given a distinct conventional form — a short poem in hexameters — in which was expressed a distinct tone of critical comment on persons or on social life. In this sense satire can be clearly traced from Lucilius through Horace to Persius and Juvenal. Of the four Horace is incomparably the most humorous and in reality the most penetrating; Lucilius is preserved only in fragments, Persius is obscure, and both the objects of Juvenal's satire and the indignation with which he attacks them are too real to give pleasure.

In the prose literature of Rome, oratory and history hold the first place. In both the art took substantial form before the national tendency was overwhelmed by the finished Greek productions. Oratory is represented in the extant literature only by some late Panegyrics and the speeches of Cicero, a small amount in comparison with the volumes of the Attic orators. It is peculiarly unfortunate that we have none of the political speeches which played so large a part in the history of the republic; they would undoubtedly illustrate the prevailingly practical character of Roman oratory and would show how steadily it grew to the height of Cicero's 'Second Philippic.' Up to this point, while it was increasingly stimulated by the best Greek models, it was able to resist the influence of Greek rhetoric. After Cicero's time the teaching of rhetoric, which had become common in Rome, brought about an undue attention to form and a consequent loss of power.

The writing of history also long served a practical end. It began as a mere expansion of the official annual records, including the names of magistrates, the important public events and the recognized prodigies. This kind of history continued to be written after Naevius and Ennius had composed more elaborate histories in verse, and, even when Roman history was written in the Greek language, it was but little influenced by the great Greek models. It is with Sallust and Nepos that the writing of history really began and its importance in Latin literature is attested by the long line of minor historians.

Roman philosophy can make no claim to originality. It is found, in prose, in Cicero and Seneca. The former gave free renderings of the best Greek works on ethical philosophy with special reference to its value in the training of the orator; the latter wrote without much system brief essays on ethics.

Of epistolary literature, either letters actually sent to the persons addressed or essays in epistolary form, a considerable amount is known through allusions and the two collections by Cicero and Pliny have been mentioned. They are a unique feature of Roman literature, since it happens, perhaps from the concentration of Greek life in single cities, that no such collections are extant in Greek.

Of the technical writings enough has been said. They belong to all periods of the literature and cover almost all fields of study, agriculture, grammar, literary criticism, architecture, medicine, rhetoric, military strategy, engineering, astronomy, law; the first and the last subjects in this list being by far the most abundant and important.

In comparison with the Greek literature the Latin is inferior in imagination and in form — two important characteristics; it is superior in the directness of its human appeal and in its practical worth to the modern world. It is sometimes said to be an imitative literature, but it is rather a continuation of Greek literature in new surroundings. The influence of Greek literature upon Roman is not different in kind from the influence which modern literatures exert upon each other.

A comparison with modern literature is less easy, because the differences are greater. The ancient literatures follow more strictly defined lines of tradition, especially in poetry. The Roman circle of readers was more limited than the modern and literature was therefore less broadly based and less representative of a wide variety of interests. And the comparative absence of the romance or novel and the slight use of the motive of romantic love makes a very obvious difference. See articles on the individual authors mentioned, for further biographical and critical material. See also LATIN WRITERS; CLASSICAL LITERATURE.

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LATIN LITERATURE OF THE MIDDLE AGES. The very greatness of the Roman Empire gives the reason for its dissolution, even apart from the barbaric invasions, and the vicissitudes attending this dissolution were reflected in the cultivated and the popular language alike. There was this exception, however; the latter preserved its vitality upon the tongues of the people, while the former tended to become a sort of official *lingua franca* with the monks and notaries, and even with the learned was modified by the influence of the colloquial dialects and new forms of thought, until it lost nearly every vestige of its former elegance and grace and became the barbarous Latin which, after serving as vehicle for the thought of western Europe for seven centuries, contributed to the later revival of that tongue in its classic purity that was so important a feature of the Renaissance.

The Latin language during the centuries of the literary decadence could not of course be maintained in this classic purity. On the one hand, the prevalence of vulgar idioms and the accumulation of foreign elements through the granting of citizenship to all the subjects of the empire, and, on the other hand, the rapid transformation of thought which, to give expression to new ideas, constrained the words to new meanings often far removed from their origin — these were the elements which contributed to the rapid corruption of the literary language. Meanwhile, in the individual provinces, the mixture of the official language with the dialectal elements and the natural differentiation due to a variety of causes had brought about the birth of different forms of the language from the 3d century on; so that the Gallic Latin, for example, had its own characteristics which distinguished it from the African Latin with its bombastic sonority. These were the first germs of new languages which were to spring from the root of Latinity. Nevertheless, although it is probably impossible to determine just when Latin ceased to exist as a spoken language among the common people, it continued throughout the Middle Ages to be the language of the Church, of the law courts and of both religious and secular education and in this way became the medium of no inconsiderable number of real literary productions.

It is generally conceded that the Middle Ages began with the fall of the Empire of the West in 476, for it was then that the civilization and culture of the ancient Romans succumbed to the barbarians. It is from this point, then, that we begin the history of the Latin literature of the Middle Ages, continuing from that date to the fall of Constantinople in 1453. For purposes of discussion, it will be convenient to make roughly a division into periods, although this does not necessarily connote abrupt changes. From 476 to the 8th century Latin literature is found in a condition of deepest decline, from which it recovers by progressive steps through the ecclesiastical renaissance (from the 8th to the 10th centuries) and the period of scholasticism (from the 11th to the 14th centuries) to the world Renaissance (from the 14th century on). Without making these arbitrary limits too hard and fast, we shall proceed to enumerate briefly the chief authors in the various fields of literature.

1. **Pre-Carolingian Period.**— With the triumphant spread of Christianity, the things of the world had lost their appeal and the thinking man begins to look within; after the conversion of Spain and France, the only worthy objects of human endeavor are the restoration of God's kindom on earth and the struggle against earthly enticements to sin. There arose a natural antagonism to pagan literature and consequently to pagan literary forms and ideals, many Christian writers professing to despise exactness in writing, "since I think it utterly unworthy," as Pope Gregory said, "to constrain the words of the divine oracles under the rules of Donatus." At any rate, the fall of the Western Empire and the supremacy of the barbarians ended by giving the last blow to the language of Cicero and Virgil, reducing it very quickly to a language of official formulas, which the people were certainly not at all anxious to learn, content as they were with their own vulgar dialect.

Latin literature then became identical with the record of Christian writers and the purely Roman element, or one might say the purely literary element, was bound to suffer in consequence. The apologetics and polemics of the early patristic literature disappeared with the spread of religion and Christian literature tended to go in new directions, chiefly toward mysticism and away from dogma, which was no longer of prime importance because of its universal acceptance. This tendency was manifested, for instance, in the abandonment of the purely textual criticism of the Holy Scriptures for interpretative criticism and also in hagiography, that fertile field of holy romance so important throughout the Middle Ages. Moreover, the influence of the Christian hymns caused accentual rhythm and rhyme to be firmly established in literary Latin upon the same footing as classic metre.

Although all literary life gradually became extinguished with the transfer of the seat of the empire to Byzantium and the supremacy of the barbarians in all the Western provinces, some remnants remained, especially in Africa and Gaul, and in Italy too during the reign of Theodoric, which was a time of peace. Poetry was cultivated by the African school under the dominion of the Vandals likewise. Among the African poets were Dracontius, Luxorius and Corippus, and of the non-African poets mention should be made of Alcimus Ecdicius Avitus, Magnus Felix Ennodius, Maximianus and Venantius Fortunatus, the latter being famous as a hymn-writer.

This period of barbarity also saw a few truly great examples of prose-writers. First of all, Anicius Manlius Torquatus Severinus Boethius (480–524), the celebrated Roman senator who was imprisoned by Theodoric and condemned to death. While in prison he composed his most famous work, 'De consolatione philosophiæ,' a mixture of prose and verse after the manner of Martianus Capella in which the author imagines that Philosophy appeared to him in prison and consoled him for his sufferings. Boethius composed many other works on philosophy and mathematics as well as on Christian doctrine.

Next to Boethius in importance is Magnus Aurelius Cassiodorus Senator (c. 480–575), the secretary of Theodoric, outliving him as well as the fall of the Goths and the coming of the Lombards. The last years of his life were passed in the retirement of a cloister founded by himself, and it was he who introduced the rule of copying manuscripts which has preserved for us the treasures of the ancient classics. His activity as a writer embraces two periods, that of his political life and that of his cloistered life. To the first period belong panegyric orations in praise of the Gothic kings; 'Chronica'; 'History of the Goths,' of which we have only the epitome made by the Goth Jordanis, and a collection in 12 books of everything written in connection with his office. To the second period belong 'Institutiones divinarum et sæcularium litterarum' and several other works.

The chief historian of the period is Gregory of Tours (538–593), author among other works of miraculous legends of the saints, but more especially of 10 books of 'Historia Francorum,' which won for him the appellation, 'Herodotus of the Franks.' Only improperly does one number among the historians the Briton Gildas, called the Wise.

Among the theological writers should be mentioned Benedict of Nursia (c. 480–543), the founder of Monte Cassino, who wrote a 'Regula' which was extremely important in later monastic development. But ahead of all stands Pope Gregory I, surnamed the Great (c. 540–604), from whom, besides biblical commentaries, homilies and a book on the duties of the sacred ministry, we have many (800) letters, important for the history of the time, and eight or nine hymns. Excluding these and Eugippus (511), the author of the incomparable biography of Saint Severinus, the theological writers of the period belong to the provinces of North Africa (Verecundus and others) and Spain (Leander of Seville and Martin of Bracara).

Grammar and erudition also in this period found some valiant cultivators. Besides Fabius Planciades Fulgentius, there was at the time of the Emperor Anastasius (491–518), the grammarian, Priscian of Cæsarea, who wrote at Constantinople, but in Latin, 18 books 'Institutionum grammaticarum,' in which he has handed down to us the most complete work on the Latin language, especially important for the many remnants of ancient literature which are there preserved. From a pupil of Priscian, Eutyches, we have an 'Ars de Verbo' in two books. Although living in the East, these were the last grammarians of any value; in the West studies were entirely decadent, as may be seen, for example, from the grammatical writings of Virgilius Maro, a Gaul of the 6th or 7th century, full of ridiculous questions and whimsical speculation.

In the midst of such great agitations of peoples and changes in government as were attendant upon the incursions of the barbarians, it is natural that there was felt the need for establishing a standard of law by combining the dispositions of the Roman laws with the new barbarian constitutions. In the West attempts to satisfy the new needs are found in the 'Edictum Theoderici Regis' (500), the 'Lex Romana Visigothorum' or 'Breviarium Alarici' (506) and the 'Lex Romana Burgundionum' (516). But the most important was the 'Corpus Iuris' prepared in the East by Justinian (527–565), consisting in two principal parts, the law of the jurisconsults («ius vetus») and the imperial law («ius principale»). The latter was codified in the 'Codex Justinianus' (528 and 534), the former was divided into 50 books called 'Digesta' or 'Pandectæ' and was prepared (530–532) by a commission of jurists under the leadership of the famous Tribonian. Contemporaneously there was prepared a new book of fundamental doctrine in the 'Institutiones' (four books), based principally on that of Gaius. Later, to this Justinian collection were added the subsequent dispositions under the title of 'Novellæ' in several private collections. This grand collection of juridical works is perhaps the greatest inheritance that Roman antiquity has bequeathed to modern civilization.

By the 7th century all literature had ceased in Italy and in France. Only in the Visigothic kingdom in Spain did some remnants of the ancient culture remain. There we find the bishops Eugenius and Julian of Toledo, but the most prominent figure of this time is Isidore (c. 570–636), bishop of Seville, the author of many historical, grammatical and theological writings. The most important is the work entitled 'Etymologiarum Libri XX,' containing the exposition of the seven liberal arts, of medicine, of jurisprudence, of religious history and finally the treatise (books 9–20) on questions of language. For the knowledge assembled there, it has considerable importance, notwithstanding the lack of critical discrimination.

The deterioration of classical culture becomes very marked in this century. Quite barbaric is the Latin of the Frank Fredegar and his continuators, who wrote an extremely valuable chronicle of the times. An echo of classic culture, however, resounds in England with Aldhelm (c. 650–709), the writer on prosody, with the Venerable Bede (674–735) of Northumberland, whose erudition arose above the standard of his time, with Tatwine (d. 734), archbishop of Canterbury, grammarian and poet, and with Boniface (683–755), the author of a grammatical manual, who later became the «Apostle of the Germans.» Bede was a prolific writer in nearly every field of literature. Besides lives of the saints in metrical form and other poems, he wrote grammatical, mathematical and theological treatises, sermons, and especially the 'Historia ecclesiastica gentis Anglorum' and the 'Chronicon.' In the works of all of the above writers, however, with the classical elements are now commingled many elements of strictly mediæval culture.

To this century also belong the Irish poet, Columbanus (543–615), the founder of the monastery of Bobbio which later became famous as the home of learning in northern Italy, and his fellow-countryman, Adamnan (c. 624–704), the author of a biography of Saint Columba, «the most complete piece of biography that all Europe can boast of throughout the Middle Ages.»

2. Carolingian Period.— The Carolingian Age marks a comparatively sharp division in the literary history of Latin. It brought learning into good repute again and furnished material for writers. Besides a theological literature of imposing proportions, this period produced a vast body of poetry, epistles and historical writings, all based more or less consciously on classical models. The leader of this revival was Alcuin (c. 735–804), although his importance as a teacher surpasses that as a writer. After teaching 15 years at York he went over to France and presided over the court school of Charlemagne. Besides several treatises on grammar and rhetoric in dialogue form, he also composed scriptural commentaries, works upon astronomy and metrics and poems.

The teacher of Greek at Charlemagne's court school was Paul Warnefrid, better known as Paulus Diaconus (c. 725–797), the first important historian of the Middle Ages after Gregory of Tours. He was also prominent on account of the extent of his classical culture and literary skill, which were singularly displayed in the six books of his 'Historia Langobardorum,' written at Monte Cassino, and in his summary of the abridgment of Varrius Flaccus by Pompeius Festus. In the latter half of the 8th century the Irish monk, Dicuil, composed a summary of geography.

Linking the 8th to the 9th century the tradition of learning which Alcuin had brought from York to Tours was transmitted through Rabanus Maurus (c. 776–856) to Fulda. Apart from extensive commentaries on the Old and New Testaments, he wrote several educational treatises and a sort of encyclopedia entitled 'De universo.' Among the pupils of Rabanus was the future abbot of Reichenau, Walafrid Strabo (c. 809–849), who studied Christian and pagan poets and wrote on sacred as well as secular themes. His 'Hortulus,' a description of plants in the monastery garden, was widely read during the years following, while his 'Visio Wettini' is justly regarded as a prototype of Dante's 'Divine Comedy.' Four biographies of saints, two in prose and two in verse, are also attributed to him.

In the middle of the 9th century flourished Sedulius Scotus, the author of a commentary on Porphyry and a guide for princes entitled 'De rectoribus Christianis,' and Joannes Scotus Eriugena, the author of a commentary on the Gospel of Saint John and glosses on Martianus Capella and Boethius, besides his philosophical work, 'De divisione naturæ.' In the latter half of this century appeared the monk of Saint Gall, Notker Balbulus, who wrote legends and anecdotes, 'Gesta Caroli Magni.'

Besides the writers mentioned above, each of whom wrote in several departments of literature, there were several authors during the first part of the Carolingian period who attained prominence in some one particular field. In philology and grammar, mention might be made of Servatus Lupus, abbot of Ferrières, and Eric and Remi of Auxerre, authors of glosses and commentaries on the Bible, Priscian, Boethius, Martianus Capella and Aristotle. In poetry stands forth the name of Theodulf (c. 760–821), who occupies the first place among the Carolingian poets, and in history, the names of Anastasius Bibliothecarius (c. 810–879), the compiler of an historical work, 'Chronographia tripartita,' and other historical works, Willibald, the author of a life of Saint Benedict, and Einhard (c. 770–840), a layman, educated at Fulda. The latter composed in admirable Latin a 'Life of Charlemagne,' modeled after the 'Life of Augustus' of Suetonius, and several other works of an historical character.

In the 10th century the monastery of Gandersheim was famous as the retreat of the nun-poetess, Hroswitha (c. 930–c. 1002). With a view to providing the age with a purer literature than that of Latin comedy, she composed six moral and religious plays, in which she imitates Boethius as well as Terence. Two biblical poems, six legends and two epics are ample evidence of her industry and an exceptional number of recent editions of her plays attests her enduring popularity. In the middle of this century also appeared an epic which in some ways indicates the high-water mark of pure literature in mediæval Latin. This is the 'Waltharius' of the monk Ekkehard. The fascinating story of the elopement of Walter of Aquitaine with the Burgundian princess Hildegunde forms the theme of the poem and is treated with exceptional good taste and dramatic skill — a Teuton legend in Latin dress. Other important personages in this century were Gerbert, later Sylvester II, a writer on philosophical, mathematical and physical subjects who was a great admirer of the classics, and Luitprand, a Lombard, important for Italian history.

The 11th century saw the rise of the Goliard songs popular with itinerant clerical students. These were lyrical in form, but they were often far from lyrical in substance and feeling, so that the Goliards were finally suppressed. These songs seem to have been the precursors of modern college songs of the type of the 'Gaudeamus igitur.'

3. Scholastic Period.— Although during the two centuries following the reign of Charlemagne letters suffered a partial eclipse due to the last great invasion from the North, in the monasteries the classic authors were still read and studied and copied — in fact it is to the tireless work of the monks that we owe the preservation of the classical texts — and in this manner the way was paved for the great scholastic movement which followed. The rise of the universities and the elaboration of scholastic philosophy after the Crusades brought about another linguistic creative period. Scholasticism, however, in the broad sense of the word, began much earlier than the mediæval schools. There is no absolute break between the patristic and the scholastic literature. The Church Fathers who flourished before the fall of Rome were followed by the writers of compendia of universal knowledge, such as Cassiodorus, Isidore and Bede, through whom the slow demarcation of the field of philosophy was brought about and philosophical problems gradually assumed their proper place, but until the 12th century there was a lack of systematization. The last great representative of scholastic philosophy cast in the non-systematic form is Saint Anselm (c. 1033–1109), a native of Lombardy who later became archbishop of Canterbury.

Scholasticism, in the more restricted sense, begins with the 12th century. On the ground that truth cannot contradict truth, it seeks to harmonize the teachings of the Christian religion with the results of philosophical investigation. This is not the proper place, however, for a history of scholasticism, except in so far as it produced works of literary merit. It will be sufficient for our purpose to mention merely its chief exponents. After Roscelin and William of Champeaux comes Peter Abelard (1079–1142), famed as a teacher and of great influence in the next century. His most important contribution to philosophy and theology was his 'Sic et non,' although he composed other works on a variety of subjects. Adelard of Bath was one of the first mediæval scholastics to seek knowledge by traveling in Greece and Asia. Other writers of prominence in scholasticism of the 12th century were Hugo and Richard of Saint Victor, Alain de l'Isle and Peter Lombard (c. 1100–c. 1160). The latter was the author of four books of 'Sentences,' which became the object of innumerable commentaries in the years that followed.

Strictly literary productions, however, were comparatively rare in the 12th century. John of Salisbury (c. 1115–80) has left us lives of Saints Anselm and Thomas of Canterbury and several other historical and philosophical works, and Bernard of Clairvaux (1090–1153) has left us, among other works, his 'De consideratione ad Eugenium,' the chief idea of which is that the reformation of the Church should begin with the sanctity of its head. In the field of poetry the writers are more numerous. Among these are the prolific hymn-writer, Adam of Saint Victor, "the foremost among the sacred Latin poets of the Middle Ages" (Trench); Bernard of Cluny, author of the hymn 'Jerusalem the Golden,' besides a satiric poem 'De contemptu mundi'; Joseph of Exeter with his epic on the Trojan War; Hildebert, author of lives of Queen Radegundis, etc., besides hymns and other poems, and Walter of Chatillon, in whose 'Alexandreid' occurs the well-known hexameter 'Incidit in Scyllam qui vult vitare Charybdim' (He falls into Scylla's jaws who would escape Charybdis).

The greatest representatives of scholasticism come in the 13th century, after the works of Aristotle had become thoroughly known. The first of these, in the point of time, is Alexander of Hales (d. 1245), a Franciscan. Then in rapid succession come the Dominicans, Albertus Magnus (c. 1206–80), an indefatigable writer upon a multiplicity of subjects besides philosophy and theology, and his famous pupil, Thomas Aquinas (1225 or 1227–74), with his ‘Summa theologica’ and ‘Summa contra gentiles,’ besides commentaries upon Aristotle and Peter Lombard. Other commentaries on the ‘Sentences’ were composed by Saint Bonaventure (1221–74), who also wrote mystical and exegetical works, and Joannes Duns Scotus (c. 1270–1308), author of numerous treatises on disputed questions. Besides these, mention should be made of the natural philosopher, Roger Bacon (c. 1214–94); the controversialist, Raymond Lully (c. 1235–1315); the encyclopedist, Vincent of Beauvais (c. 1190–c. 1264), and the liturgical writer, Durandus (c. 1237–96), called «Speculator.» Few scholastics are to be noticed after the 13th century. Outside of William Ockam (c. 1280–c. 1349), there are the mystics, John Ruysbroek, Denis the Carthusian, and Maître Eckhart.

The 13th century also witnessed the production of such famous hymns as ‘Dies Iræ,’ ‘Pange Lingua’ and ‘Stabat Mater,’ and it was in this century that Jacobus de Voragine wrote his ‘Legenda Aurea,’ and Matthew of Paris, the last and perhaps the greatest of monastic annalists, lived. In the early part of this century a striking contrast to Ekkehard's ‘Waltharius’ is found in the ‘Troilus’ of Albertus Standensis, whose theme is classical as well as the metre and innumerable centos borrowed from Virgil. A valuable contribution to the political science of the Middle Ages was the ‘De Monarchia’ of Dante (1265–1321), which is comparable with the ‘De regimine Principis’ of Saint Thomas Aquinas.

During the last three or four centuries of the Middle Ages canon and Roman law were making rapid progress. Gratian (1160) commenced the codification of the former, and his work was continued by Innocent III, Gregory IX, Raymond of Penafort and Boniface VIII, until a ‘Corpus Iuris Canonici’ was ready to take its place by the side of the ‘Corpus Iuris Civilis.’ Some of the chief commentators on canon law in the various stages of its codification were Ivo of Chartres, Henry of Segusic (Hostiensis), Joannes Andreae, Guido da Baisio and Agostino Trionfi. Many of these commentaries appeared in the form of a ‘Summa,’ arranged logically or alphabetically. With regard to Roman law some of the chief commentators were Irnerius, Azo, Accursius, Cino da Pistoja and Bartolus. During the 13th century the Institutes of Justinian were used as a model by Bracton in his collection of English laws and customs.

This brings to a close the Latin literature of the Middle Ages, for Petrarch, Boccaccio and Poggio, though living before the fall of Constantinople, logically belong with the Renaissance and are generally so considered. A retrospect over the period covered by this article leads to the conclusion that the Middle Ages were not so «Dark» as they have been pictured; that Latin literature did not die with the fall of the Western Empire, although it inevitably felt the adverse influence of barbarism, but on the contrary created or developed several literary forms of no mean value, such as hymns, romances and history, the latter representing every variety of style from the dryest of annals and mere records through real histories and biographies to historical romances; and that it was due to this preservation of the Latin language and literature and its spirit in the monasteries side by side with the vernacular that contributed in large measure to the revival of learning in the 15th century.

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LATIN QUARTER (Quartier Latin, kărt'yā'lą'tăn'), celebrated student district of Paris, in which are located the Collège de France, the Sorbonne, the Institut, the Luxembourg, Panthéon and other schools. The term is connected with youthful Bohemianism and the extremely radical views always current among certain elements of a student body. See Paris.

LATIN UNION, The. The institution of the Latin Union marks an important epoch in the history of bimetallism, for, while it was the gold discoveries of California and Australia which were the direct cause of the organization of this monetary convention, it was the downward tendency in the price of silver that resulted in the practical suspension of that coinage by the parties to the treaty.

In 1853, when the subsidiary silver of the United States had begun to be seriously affected by the cheapened price of gold, the Treasury Department found it necessary to reduce the quantity of silver in its small coins in order that they might still remain below the value of gold. A few years passed and Switzerland also found herself face to face with the same financial problem, but she, instead of following the example of the United States, solved her difficulty by lowering the fineness of standard for her small coins to 800 thousandths fine.

This method of equalizing the coinage naturally had a tendency to act disadvantageously for those countries, like France and Italy, where the standard remained much higher than that of Switzerland, for, as the coins of one nation circulated commonly in all the coumtries that had adopted the franc system, it was soon realized that, in accordance with Gresham's law, the cheaper Swiss coins would eventually supersede the dearer coins. It was unreasonable to suppose that the coins of France or Italy, containing as they did so much more pure silver, could hope to compete with the cheap coins of Switzerland, so long as the latter passed current at the same nominal value.

Such was the fear, and it was not long before these predictions began to be fulfilled. The Swiss coins, being only 800 thousandths fine, soon crossed the French frontier, where they were exchanged for French coins of the same nominal value. The latter were then exported to Switzerland, where, after having been melted and recoined, they netted a considerable profit for the speculator. By April 1864 the situation had become so thoroughly unsatisfactory that the French government was compelled to issue a decree prohibiting the receipt of the Swiss coins at the customs-house and other public offices.

In response to overtures from Belgium a conference of delegates representing four of the interested states — France, Italy, Switzerland and Belgium — met in Paris 20 Nov. 1865 and agreed to establish a uniform coinage, the new system to be based upon the principles adopted by the United States in 1853. Thus, the silver coins — the 2 franc, 1 franc, 50 centimes and 20 centimes pieces — were reduced from a standard of 900 thousandths fine to a uniform fineness of 835 thousandths, a policy which lowered the small coins of the several countries to the position of a subsidiary currency.

In adopting this policy the members of the Latin Union had not discarded the principles of bimetallism. Gold coins of the value of 100, 50, 20, 10 and 5 francs, and a 5-franc silver piece, were all to be coined at the old standard of 900 thousandths fine and free coinage, at a ratio of 15½ to 1, was granted to any holder of gold or silver bullion who desired to obtain any of the gold coins or 5-franc silver pieces. The subsidiary currency was formally declared legal tender in all business transactions between individuals of the states that coined them for an amount not in excess of 50 francs.

The treaty under which the Latin Union was formed was ratified by each government and went into effect 1 Aug. 1866. In 1868 Greece also became a party to the convention, which, by its own terms, was to exist until 1 Jan. 1880, but the downward tendency shown by silver during 1873 compelled the delegates to call another conference. On this occasion the fear most generally entertained was that the German mints would flood the several countries with their demonetized silver. A meeting was held at Paris, therefore, 30 Jan. 1874, at which the full power of free coinage of silver was withdrawn from individuals and the amount of silver 5-franc pieces to be coined by the several treaty states was greatly reduced.

The last convention of the Latin Union was held 29 Oct. 1897 and the monetary agreement accepted at that time is tacitly continued from year to year, although practically in abeyance, and it may be denounced at any time by any of the contracting states. According to its terms, the five contracting states have adopted a gold and silver coinage of the same fineness, weight, diameter and current value, and the allowance for wear and tear in each case is the same. The coinage of 5-franc pieces, of gold as well as of silver, is temporarily suspended and the issue of subsidiary silver is, with certain exceptions for special reasons, limited to 7 francs per head of the population of each state. The most important exception to this section of the convention is in the case of Greece, where the issue is limited to 6 francs per head.

It is further agreed between the contracting countries that each government, in all its public offices, shall accept payment in the silver 5-franc pieces of each of the other states, anl in the subsidiary silver to an amount not in excess of 100 francs. Moreover, each state engages to exchange the excess of its issues over its receipts of subsidiary silver for gold or 5-franc silver pieces, and each binds itself that, at the termination of the convention, it will resume also its 5-franc silver pieces, paying in gold a sum equal to the nominal value of the coin resumed. The only exception to this section of the treaty is made in the case of Italy, in which the government is freed from this obligation to take back its fractional coins upon the dissolution of the convention, it being stipulated instead that it will forbid the exportation of such coins while the Union continues and will not change its present system of subsidiary coinage for five years following its separation from the Union.

Other countries which have adopted this monetary system without joining the union are Finland, Rumania, Serbia, Russia and Spain, while the following American countries have assimilated their coinage to that of the union — Chile, Colombia, Ecuador, Guatemala, Peru, Uruguay and Venezuela. Consult Arnauné, 'La monnaie, le crédit et le change' (2d ed., Paris 1902); Palgrave, R. H. I., 'Dictionary of Political Economy' (New York 1900); and Willis, H. P., 'History of the Latin Monetary Union' (Vol. II, New York 1900).

LATIN VERSIONS OF THE SCRIPTURES. See BIBLE, VERSIONS OF.

LATIN WRITERS. The following list of writers presents the more famous names which the general student of literature is likely to meet in his reading. The authors are arranged according to the year of their birth so far as it can be determined. For further material on each author, see the separate articles on each. See also LATIN LITERATURE.

LUCIUS LIVIUS ANDRONICUS. c. 284 — 204 B.C.
With his translations of Greek tragedy and comedy Latin literature is said to begin, 240 B.C. He also translated Homer's 'Odyssey.' We have a few fragments.

GNAEUS NAEVIUS. c. 269 or 264 — c. 199 B.C.
Reckoned the first native Roman poet. He was the first to compose a Latin play. His greatest achievement was an epic on the Punic War. Only fragments survive.

TITUS MACCIUS PLAUTUS. c. 254 — 184 B.C.
Roman comic poet. Twenty of his comedies are still extant.

QUINTUS ENNIUS. 239 — 169 B.C.
The "Father of Roman Literature." Wrote tragedies and comedies, and other poetry. His chief work is an epic poem, 'The Annals,' covering the whole history of Rome.

MARCUS PORCIUS CATO. 234 — 149 B.C.
Author of the first Roman historical work in Latin prose. He published orations and didactic treatises. His work on 'Agriculture' is the oldest volume of Latin prose extant.

MARCUS PACUVIUS. c. 220 — c. 132 B.C.
Roman tragic poet. His writings are now preserved only in fragments.

PUBLIUS TERENTIUS AFER. c. 184 — 159 B.C.
Extant works, six comedies.

GAIUS LUCILIUS. 180 — 103 B.C.
First Latin satiric poet. We have only fragments.

Lucius Accius. 170 — B.C.
Author of adaptations of Greek tragedies, original Latin tragedies, and various prose works. Fragments extant.

Marcus Terentius Varro. 116 — 27 B.C.
Most learned of ancient Roman scholars. The major portion of his prose and poetry is lost, but we have considerable remains of his works on 'The Latin Language' and on 'Agriculture.'

Marcus Tullius Cicero. 106 — 43 B.C.
Of his numerous writings, we have over 50 orations, many rhetorical and philosophical treatises and about 800 letters.

Gaius Julius Caesar. 100 — 44 B.C.
His memoirs, 'The Commentaries,' alone remain.

Cornelius Nepos. c. 99 — c. 24 B.C.
Author of biographies of many eminent men.

Titus Lucretius Carus. 96 (probably)— 55 B.C.
Famous for his didactic poem 'On the Nature of Things,' which we still have.

Gaius Valerius Catullus. 87 or 84 — c. 54 B.C.
First important and perhaps the greatest Latin lyric poet. We have a collection of over a hundred of his poems.

Gaius Sallustius Crispus. 86 — 34 B.C.
Best known by his monographs on Catiline's conspiracy and the Jugurthine war.

Publius Virgilius Maro. 70 — 19 B.C.
Most representative Latin poet. His greatest works are the 'Eclogues,' the 'Georgics,' and the 'Æneid,' but we also have some of his minor poems.

Quintus Horatius Flaccus. 65 — 8 B.C.
Left satires, epodes, odes, and epistles, but is most distinguished for the perfection of his odes.

Titus Livius. 59 B.C.— 17 A.D.
Wrote a history of Rome in 142 books, of which we have 35.

Albius Tibullus. c. 54 — c. 19 B.C.
An elegiac writer, from whose pen we have about two dozen poems.

Lucius Annaeus Seneca. c. 54 B.C.— c. 39 A.D.
Of his rhetorical works we have about six books.

Sextus Propertius. c. 49 — c. 15 B.C.
Elegiac poet, from whom we have four books of verse.

Publius Ovidius Naso. 43 B.C.— 17 or 18 A.D.
His important extant poems are the 'Art of Making Love,' 'Remedies for Love,' the 'Metamorphoses,' '*Epistulae ex Ponto,*' *Tristia, Fasti, Heroides.* A famous tragedy, the 'Medea,' has not survived.

Gaius Velleius Paterculus. c. 19 B.C.— 30 + A.D.
Author of a compendium of Roman history which is still extant.

Valerius Maximus.
We have his collection of anecdotes in nine books.

Lucius Annaeus Seneca. c. 4 B.C.— 65 A.D.
From him have come a satire on Claudius, moral essays, philosophical epistles, physical treatises, and a few tragedies.

Aulus Cornelius Celsus. c. 2 A.D.— ?
Author of an encyclopedic work, of which we have only the eight books on medicine.

Phaedrus.
Author of an extant collection of fables.

Pomponius Mela.
His geographical work in three books is the earliest work of the sort that we possess.

Lucius Junius Moderatus Columella.
Author of an important work in prose and verse on agriculture, in 12 books.

Quintus Curtius Rufus.
'History of Alexander the Great,' in 10 books, all of which, except two, have survived.

Gaius Plinius Secundus. 23— 79 A.D.
Author of the 'Historia Naturalis,' an encyclopedic work in 37 books, still extant.

Silius Italicus. c. 25—c. 101 A.D.
Composed an extant epic poem on the Second Punic War, in 17 books.

Aulus Persius Flaccus. 34 — 62 A.D.
Writer of six satires, still extant.

Marcus Annaeus Lucanus. 39 — 65 A.D.
Of numerous works in prose and verse we have only his epic, the 'Pharsalia.'

Petronius Arbiter. ? — 66 A.D.
Author of a satirical romance in at least 20 books, of which we have considerable fragments.

Titus Calpurnius Siculus.
Left us seven eclogues and a poetical panegyric.

Gaius Valerius Flaccus Setinus Balbus. — c. 90 A.D.
Composer of an extant poem on the Argonautic expedition, in eight books.

Marcus Fabius Quintilianus. Between 35 and 40 — c. 95 A.D.
Known chiefly by his treatise in 12 books upon the training of an orator.

Publius Papinius Statius. c. 40 — 96? A.D.
There have survived of his works five books of occasional poems (the 'Silvae'), and two epics, a Thebaid and an Achilleid.

Marcus Valerius Martialis. c. 40 — c. 102 to 104 A.D.
The world's greatest writer of epigram, from whom we have 1,575.

Publius Cornelius Tacitus. c. 55 — c. 120 A.D.
One of the chief ancient historians. His surviving works are a treatise on oratory, a biography of Argicola, a monograph on Germany, his 'Annales' and 'Historiae.'

Decimus Junius Juvenalis. c. 60 — c. 140 A.D.
Composed 16 poetical satires, which we have.

Gaius Plinius Caecilius Secundus. 62 — c. 113 A.D.
Of his published speeches only the panegyric of Trajan has reached us, but his nine books of letters in semi-essay form, and a tenth containing his correspondence with Trajan, have survived.

Gaius Suetonius Tranquillus. 75? — 160 ? A.D.
Latin biographer, best known by his extant 'Lives of the Caesars,' although we have fragments of other biographies.

Lucius (?) Annaeus Florus.
Composed an extant epitome of Roman history in two books.

Marcus Cornelius Fronto. c. 100 — c. 175 A.D.
Besides less important works in incomplete form, we have most of his correspondence with Marcus Aurelius.

Gaius. c. 110 — c. 180 A.D.
The famous jurist, large amounts of whose writings have come down to us.

Marcus Aurelius Antoninus. 121 — 180 A.D.
Besides his letters in Latin, we have the well-known 'Meditations,' written in Greek, in 12 books.

Lucius Apuleius. c. 125 — ? A.D.
Composed works on a great variety of subjects, of which few have reached us. Most important is the novel 'The Golden Ass.'

Aulus Gellius. c. 130 — ? A.D.
His miscellanies, the 'Attic Nights,' in 20 books, have reached us almost intact.

Marcus Minucius Felix.
Author of a dialogue, the 'Octavius,' which is our earliest extant work in Latin Christian literature.

Quintus Septimius Florens Tertullianus. c. 150 — c. 230 A.D.
The great Christian apologist. We have numerous theological treatises from his pen.

Thascius Caecilius Cyprianus. c. 200 — c. 255 A.D.
Author of numerous theological works, many extant.

Marcus Aurelius Olympius Nemesianus.
We have a portion of his didactic poem on the chase.

Arnobius. ? — 326 ? A.D.
Author of a Christian apology in seven books, which have come down to us.

Lactantius Firmianus. — after 315 A.D.
Known as the Christian Cicero. We have his chief theological works in prose and verse. Most important is his 'Institutiones Divinæ.'

Eutropius. 4th century.
A historian whose epitome of the entire history of Rome, in 10 books, is still valued.

Hilarius (Bishop of Poitiers). — 367 A.D.
A Christian controversialist and commentator on the Bible, of whose numerous works we still have remains.

(Pope) Damasus. 305 — 384 A.D.
One of the first Christian poets. Epitaphs and poetical eulogies of departed Christians have come down to us.

Decimus Magnus Ausonius. c. 310 — c. 395 A.D.
A Roman poet from whom we have many works in various departments of literature, epigrams, elegiacs, epistles, etc.

Ammianus Marcellinus. c. 330 — c. 400 A.D.
Composed a continuation of 'Tactius,' of which we have only 18 books of contemporary history.

Hieronymus. 331 — 420 A.D.
Famous for his translation of the Bible and his commentaries. A Latin version of Eusebius' Chronological Tables, many letters and Christian biographies require mention.

Ambrosius. c. 340 — 397 A.D.
One of the Church Fathers. His writings include letters, orations, hymns and didactic works, of which we have large amounts.

Quintus Aurelius Symmachus. c. 345 — c. 405 A.D.
Besides fragments of his orations, we have official reports, and 10 books of letters which are of great historical value.

Aurelius Prudentius Clemens. 348 — c. 410 A.D.
The greatest poet of his century. We have hymns and other Christian poetry.

Claudius Claudianus. ? — c. 408 A.D.
Last important non-Christian poet. Extant are historical and mythological poems and many shorter pieces. Most famous is his epic, 'The Rape of Proserpina.'

Meropius Pontius Anicius Paulinus. 353 — 431 A.D.
A Christian writer from whom we have letters and poems.

Aurelius Augustinus. 354 — 430 A.D.
Widely known by his 'Confessions,' he has also left us letters, sermons, theological treatises, and his famous work, in 22 books, on 'The Kingdom of God.'

Macrobius Theodosius. 4th, 15th century A.D.
A commentary on Cicero's 'Dream of Scipio' and a book instructive to the student of Roman literature and antiquities, which he called 'Saturnalia,' have been preserved.

Martianus Capella. 4th, 15th century A.D.
We have his encyclopedic work, in nine books, on the 'Sèven Liberal Arts,' which was of great importance in mediæval education.

Leo (the First, surnamed "the Great."). c. 395 — 461 A.D.
Sermons and letters of his composition are extant.

Gaius Sollius Apollinaris Sidonius. c. 430 — c. 480 A.D.
A collection of his poems and nine books of letters are instructive for the life of his time in Gaul.

Blossius Æmilius Dracontius. 5th century A.D.
We have from him poems that are very creditable for this age, on mythological and Christian subjects, as well as two epithalamia.

Magnus Felix Ennodius. 473 — 521 A.D.
A prolific writer in several fields, whom we know through his letters, speeches, a panegyric and numerous poems.

Anicius Manlius Torquatus Severinus Boethius. c. 480 — 524 A.D.
Translator of many Greek philosophical and mathematical books. His famous 'Consolations of Philosophy' is often accounted "the last work of Roman literature."

Flavius Magnus Aurelius Cassiodorus Senator. c. 480 — c. 575 A.D.
Historical, theological and encyclopedic works, a considerable portion of which has survived.

Priscianus. 6th century A.D.
Besides some unimportant works, we have his eight books on the Latin language, the most influential grammatical work in that tongue.

Venantius Honorius Clementianus Fortunatus. c. 535 — c. 600 A.D.
Best known through his epic poem on Saint Martin of Tours, although others have come down to us, together with lives of the Saints in prose.

Gregorius of Tours. 538 — 593 A.D.
Author of theological books, including lives of the Saints. Most important to us is his 'History of the Franks' in 10 books.

(Pope) Gregorius (the First). c. 540 — 604 A.D.
We have theological works composed by him, and over 800 letters of high value to the historian.

Isidorus (Bishop of Seville). c. 570 — c. 636.
A theological, historical and grammatical writer of great influence upon the Middle Ages. Chief among the works which we have from him is his 'Origines,' in 20 books.

Walton Brooks McDaniel,
Professor of Latin, University of Pennsylvania.

LATINI, lạ-tē'nē, **Brunetto**, Italian philosopher and scholar: b. Florence, about 1220; d. about 1294. He was a notary by profession and in 1250 participated in the revolution which established a Guelph democratic government. He was sent as Ambassador to Alfonso X, of Spain, in 1260, to obtain aid in the stabilizing of the new government, but in his absence the Guelphs were overthrown and he took refuge in Paris where he remained in 1261-68. He returned to Tuscany in 1269 and for the next 20 years occupied various government offices of importance. He was an eloquent speaker and held an honored place in the councils of the government. His friendship for the poet Dante is dwelt upon in ‹Inferno,› canto xv. He wrote the earliest Italian didactic poetry, his poem ‹Tesoretto,› written in rhymed couplets of heptasyllabic metre, ‹Favolello,› a rhymed letter written to Rustico Filippo, and one canzone, being all of his authentic verse, although other compositions are credited to him. He wrote while in France an encyclopedic work, ‹Trèsor,› which was translated from French into Italian by Bono Giamboni under the title ‹Tesoro.› Consult Chabaille, ‹Li Livres don Trèsor par Brunetto Latini› (Paris 1863).

LATINS (*Latini*), the ancient inhabitants of Latium, in Italy. Janus, Saturn, Picus and Faunus, who were deified by their subjects, are represented to have been the most ancient Latin kings. These ancient Latins formed a league of 30 cities, of which the town of Alba Longa became the head. Although Rome was a colony from Alba she became powerful enough in the reign of her third king to seize upon that city and raze it to the ground. Under Servius Tullius, Rome entered the Latin confederacy and in the reign of his successor, Tarquinius Superbus, was acknowledged as head of the league. On the fall of the Tarquins the Latins regained their independence and struggled long against the republic to maintain it; it was finally lost, however, by the decisive victory of the Romans near Mount Vesuvius (340 B.C.).

LATINUS, lă'tĭn-ŭz, Roman legendary king of the Laurentians in Latium and eponymic ancestor of the Latin race of ancient Italy. In Hesiod he is king of the Tyrsenians, son of Ulysses and Circe. In Virgil's ‹Æneid› (VII–XII) he is the son of Faunus and the nymph Marcia and reigns over Latium. He welcomes Æneas upon his landing at the mouth of the Tiber and Æneas subsequently marries Latinus' daughter Lavinia and succeeds to the throne. There are other legendary accounts of Latinus but his importance in mythology lies in the effort to make him a connecting link between Rome and Troy.

LATITUDE. The astronomical latitude of a place is the altitude of the celestial pole on the declination of the zenith. From the mechanical point of view it may be defined as the angle between the plane of the earth's equator and the observer's plumb-line or vertical. Neither of these definitions makes an assumption as to the form of the earth and this astronomical latitude is seldom identical with the geocentric, nor even with the geodetic latitude of a place. It is, however, the only kind of latitude which can be directly determined from astronomical observations. There are six methods of determining latitude.

1. **By Circumpolars.**— This most obvious method is to observe, with the meridian circle or some analogous instrument, the altitude of a circumpolar star at its upper culmination, and again, 12 hours later, at its lower. Each of the observations must be corrected for *refraction* and the *mean of the two corrected altitudes will be the latitude.* This method has the advantage of being an *independent* one and does not require any data (such as the declination of the stars used) to be accepted on the authority of previous observers. But to obtain much accuracy it requires considerable time and a large fixed instrument. In low latitudes the refraction is also very troublesome.

2. **By the Meridian Altitude or Zenith Distance of a Body of Known Declination.**— If we use the meridian circle, we can always select stars that pass near the zenith where the refraction will be small; moreover, we can select them in such a way that some will be as much north of the zenith as others are south and thus *eliminate* the refraction errors. But we must take our star declinations out of catalogues made by previous observers and so the method is not *an independent* one. At sea the latitude is usually obtained by *observing with the sextant the sun's maximum altitude,* which of course occurs at noon. Since at sea it is seldom that one knows beforehand precisely the moment of local noon, the observer takes care

to begin to observe the sun's altitude some 10 or 15 minutes earlier, repeating his observations every minute or two. At first the altitude will keep increasing, but immediately after noon it will begin to decrease. The observer uses, therefore, the *maximum* altitude obtained, which, corrected for refraction, parallax, semidiameter and dip of the horizon will give him the true latitude of his ship. On account of the sun's motion in declination and the northward or southward motion of the ship itself, the sun's maximum altitude is usually attained not *precisely* on the meridian, but a few seconds earlier or later. This requires a slight correction to the deduced latitude, explained in books on navigation or practical astronomy.

3. **By Circum-meridian Altitudes.**— If the observer knows his time with reasonable accuracy, he can obtain his latitude from observations made when the body is *near* the meridian, with practically the same precision as at the moment of meridian passage. The great advantage of this method is that the observer is not restricted to a single observation at each meridian-passage of the sun or of the selected star, but can utilize the half-hours preceding and following that moment. The meridian-circle cannot be used, as the instrument must be such as to make extra-meridian observations possible. Usually the sextant or universal instrument is employed.

4. **The Zenith Telescope Method.**— This method is generally known as the American, because first practically introduced by Captain Talcott of the United States engineers, in a boundary survey in 1845. Its essential characteristic of the *micrometric* measurement of the *difference* between the nearly equal zenith distances of two stars which culminate within a few minutes of each other, one north and the other south of the zenith and not very far from it; such pairs of stars can always be found. When the method was first introduced, a special instrument, known as the zenith telescope, was generally employed, but at present a simple transit instrument, with declination micrometer and a delicate lever attached to the telescope tube, is ordinarily used. The telescope is set at the proper altitude for the star which first comes to the meridian and the "latitude level," as it is called, is set horizontal; as the star passes through the field of view its distance north or south of the central wire is measured by the micrometer. The instrument is then reversed and so set by turning the telescope up or down, then the level is again horizontal. After this reversal and adjustment, the telescope tube is then evidently elevated at exactly the same angle as before, but on the opposite side of the zenith. As the second star passes through the field, we measure with the micrometer *its* distance north or south of the centre of the field; the comparison of the two micrometer measures gives the *difference* of the two zenith distances. The great advantage of the method consists in its dispensing with a *graduated circle,* and in avoiding almost wholly the errors due *to refraction* it virtually utilizes the circles of the fixed observatories by which the star declinations have been measured, without requiring them to be brought into the field. Years ago it was not always easy to find accurate determinations of the declinations of the stars employed, but at present the star catalogues have been so extended and improved that the difficulty has practically disappeared, so that this method of determining the latitude is now not only the most convenient and rapid, but is quite as precise as any, if the level is sufficiently sensitive.

5. **By the Prime Vertical Instrument.**— Here we observe simply the moment when a known star passes the prime vertical on the eastern side, and again upon the western side. Half the interval will give the *hour-angle* of the star when on the prime vertical. The distance of the star from the pole is the complement of the star's declination. The observations are not so convenient and easy as in the case of the zenith telescope and the number of stars available is less; but the method presents the great advantage of requiring nothing but an ordinary transit instrument, without any special outfit of micrometer and latitude level. It also evades the difficulties caused by refraction.

6. **By the Gnomon.**— The ancients had few or no instruments and of course could not use the preceding methods of finding latitude. They were, however, able to make a very respectable approximation by means of the simplest of all astronomical instruments, *the gnomon.* This is merely a vertical shaft or column of known height erected on a perfectly horizontal plane; and the observation consists in noting the length of the shadow cast at noon at certain times of the year. It is easy to complete the sun's zenith distances when farthest north and south; and, since the sun travels equal distances north and south of the celestial equator, the mean of the two results will give the angular distance between the equator and the zenith; i.e., the *declination of the zenith,* which is the latitude of the place. This method is an independent one, like that by the observation of circumpolar stars, requiring no data except those which the observer determines for himself. Evidently, however, it does not admit of much accuracy, since the penumbra at the end of the shadow makes it impossible to measure its length precisely. The ancients instead of designating the position of a place by means of its latitude, used its *climate* instead — the climate being the *slope* of the plane of the celestial equator, which is the complement of the latitude. Many of the Egyptian obelisks were erected primarily for use as gnomons and were used for that purpose.

Since the moon and the principal planets keep within the Zodiac, the ecliptic is a most convenient circle of reference and was used as such by the ancients. Consequently great care must be taken to avoid confusion of celestial latitude and longitude with right ascension and declination or with terrestrial trial latitude and longitude. The terms right ascension and declination are of comparatively recent introduction, celestial latitude and longitude being much older. See LONGITUDE.

LATITUDINARIAN, a term applied to a school of religious thought which flourished in England in the 17th century. It was characterized by a tolerant spirit toward dissenters and an insistence on adhesion to the fundamentals of Christianity rather than to any professed ecclesiastical system as the basis of church membership. Its principal leaders were Hales, Chillingworth and Taylor. The Cambridge Platonists (q.v.) and later the Broad Church party are the heirs of the Latitudinarians.

LATIUM, lā'shĭ-ŭm, a name given to the country inhabited in ancient times by the Latins, between the Apennines and the sea. The principal part of this country was the Campagna di Roma (q.v.). After the conquest of the neighboring tribes, the Volsci, the Hernici and the Aurunci by the Romans, the name Latium was used to denote all the country between the Tiber and the Garigliano (formerly Liris). The chief early cities were Ardea, Lavinium, Tusculum, Laurentum and Alba Longa. Rome kept pushing toward the coast, absorbing all those who opposed her and eventually conquered the communities of Latium which had banded together in the Latin League. In 340 B.C. these cities revolted, but were unable to prevail against Rome and so lost their political unity. They were finally and completely conquered in the Social War 89 B.C., when the inhabitants of Latium became full Roman citizens.

LATONA, lā-tō'nạ, was the mother of Apollo and Artemis. During her pregnancy she was persecuted by Hera, by whose command the dragon Python threatened her with death and the earth was not permitted to allow her a place for her delivery. After long wanderings she found rest on the floating island of Delos which granted her refuge on the strength of Leto's promise that the island should become the seat of the deity to whom Latona would give birth there. Latona is represented as a mild, benevolent goddess, in a sea-green dress. With Artemis she cured the wounded Æneas and crowned him with glory. When Artemis fled to Olympus from the anger of Hera, Latona carried to her her quiver and arrows, which she had left behind. She was worshipped chifly in Lycia, Delos, Athens and other cities of Greece. In Crete a festival was celebrated in honor of her, called *Ecdysia*.

LATOUR D'AUVERGNE-CORRET, Théophile Malo de, tā'ō-fēl mā'lō dė lā-toor dō-vārn-yē-kor-rā, French soldier: b. Carhaix, Brittany, France, 23 Nov. 1743; d. Oberhausen, Bavaria, 27 June 1800. He early decided to become a soldier and when the French Revolution broke out was among the first to rally round its standard and distinguished himself in the army of the Pyrenees. Higher appointments were offered him but he declined, declaring that he was only fit to command a company of grenadiers and was consequently named by Napoleon «First Grenadier of France.» His corps generally made the vanguard and was called «the infernal column.» In 1799 he fought under Massena in Switzerland and fell while attached to the army of the Rhine. His heart was embalmed and carried in a silver box by one of the company in which he had served; his name was always called, the oldest sergeant answering — «Died on the field of honor.» As an author he made himself known by a singular work on the early history of Brittany, entitled, ‹Nouvelles recherches sur la langue, l'origine, et les antiquités des Bretons› (1792).

LATREILLE, lạ'trā'y', Pierre André, French naturalist: b. Brives-la-Gaillarde, Corrèze, 20 Nov. 1762; d. Paris, 6 Feb. 1833. He entered the College Lemoine at Paris in 1778 and was ordained a priest in 1786, afterward retiring to Brives, where in addition to his duties he made a study of entomology and zoology. He returned to Paris in 1788 and was elected to the Society of Natural History; the Revolution, however, interrupted his career and he was for a time imprisoned at Bordeaux as a sympathizer of the royal cause. He was elected corresponding member of the Institute in 1798 and was given charge of the arrangement of the entomological collection at the Museum of Natural History, Paris. He became a member of the Academy of Sciences in 1814, and in 1821 a chevalier of the Legion of Honor. He was appointed professor of zoology of crustaceans, arachnids and insects at the Museum in 1830. His fame rests chiefly upon his reforms in entomological classification. Author of ‹Mémoire sur les mutilles découvertes en France›; ‹Précis des caractères génériques des insects, disposés dans un ordre naturel› (1796); ‹Histoire naturelle des singes› (2 vols., 1801); ‹Histoire naturelle générale et particulière des crustacés et insectes› (14 vols., 1802–05); ‹Genera crustaceorum et insectorum, secundum ordinem naturalem in familias disposita› (4 vols., 1806–07); ‹Familles naturelles du règne animal› (1825); ‹Cours d'entomologie› (1 vol. completed, 1831), etc.

LATROBE, lạ-trōb', Benjamin Henry, American architect: b. Yorkshire, England, 1 May 1764; d. New Orleans, 3 Sept. 1820. He studied at the University of Leipzig, served in the Prussian army as cornet of hussars, became an architect in England, achieved distinction as an engineer in London and came to Norfolk, Va., in 1796. He built the James River-Appomattox Canal and the Richmond penitentiary; removed to Philadelphia and there designed the Bank of the United States, the Bank of Pennsylvania, the old Art Academy and other structures; and supplied the city with Schuylkill water in 1800. The Roman Catholic Cathedral at Baltimore is also his work. In 1803 he was appointed surveyor of public buildings in Washington and later was chosen architect of the capitol. After the burning of the capitol by the British in 1814, he was appointed to rebuild it, but in 1817 resigned. His ‹Journal: Notes and Sketches of an Architect, Naturalist and Traveler› was published in 1905.

LATROBE, John Hazlehurst Bonval, American lawyer: b. Philadelphia, 4 May 1803; d. Baltimore, 11 Sept. 1891. He was the son of Benjamin H. Latrobe (q.v.). He studied at the United States Military Academy, was called to the bar in 1825, from 1828 until his death was counsel for the Baltimore and Ohio Railway Company. He was the founder of the Maryland Institute. He also invented a stove commonly known as the «Baltimore heater.» Latrobe was long identified with the American Colonization Society and succeeded Henry Clay in its presidency in 1853. He also became president of the Maryland Historical Society and published a ‹Biography of Charles Carroll of Carrollton› (1824); a ‹History of Mason and Dixon's Line› (1854); ‹Personal Recollections of the Baltimore & Ohio Railroad' (1858) and other works.

LATROBE, Pa., town and borough in Westmoreland County, on the Loyalhanna Creek and on the main line of the Pennsylvania Railroad and the terminus of the Ligonier Valley Railroad, is situated 40 miles east of Pittsburgh and 40 miles west of Johnstown at the foot of the Chestnut Ridge and the opening of the rich Ligonier Valley. It is the centre of a large agricultural district; valuable deposits of coal and iron ore are worked and coke manufacturing is carried on to a considerable extent. Latrobe has a large number of factories, including large steel mills, woolen mills, paper mills, flour mills, mattress factory, sand works, brick works. Its public institutions include eight elementary schools and high school, 12 churches, a girls' academy and men's college, both within three miles, also hospital and city building. Pop. 11,000.

LATROBITE, a mineral named after C. I. Latrobe. It is found massive and crystallized in forms belonging to the triclinic system; but the crystals are not well defined; color, pale pink; scratches glass; specific gravity, 2.8; opaque; lustre vitreous. It is composed of silica, alumina and lime, being a rare variety of anorthite (q.v.) or lime feldspar. See Feldspars.

LATRODECTUS, a genus of spiders of the loose-web building family *Theridid*æ, which contains certain large American species popularly considered poisonous, especially one (*L. mactans*) known in the tropics as the katipo. This spider, according to Emerton, is sometimes half an inch long, with a round abdomen and the whole body black except a bright red spot on the under side and one or more red spots over the spinnerets and along the middle of the back; the small and few males have in addition red vertical stripes on each side. This spider makes a large funnel-shaped nest among loose stones, which may spread out two or three feet. It is found all over the country from Canada to Argentina and Chile, and is everywhere feared, but there is no good reason for considering it any more poisonous than other spiders.

LATTEN, a compound or mixed metal resembling brass used in the Middle Ages for metal work. Mines of latten are mentioned as existing in the time of Henry VIII, and the compound is often alluded to in ancient public records, without students of antiquity being able to determine what composition is meant. Three varieties were distinguished, the *black*, the *shaven* and the *roll*. That used by English workmen used to be imported from Germany and the Netherlands, the finest kind being known as Cologne plate. Latteners formed one of the recognized crafts of London. In some localities the term is still applied to plate-tin.

LATTER DAY SAINTS, Church of Jesus Christ of. See Mormons.

LATTER DAY SAINTS, Reorganized Church of Jesus Christ of. See Reorganized Church of Latter Day Saints of Jesus Christ.

LATTICED DRAINAGE. See Trellised Drainage.

LATTICELEAF, lăt'ĭs-lēf, or **LATTICE-PLANT** (also called laceleaf and water-yam), a remarkable aquatic plant (*Aponogeton fenestralis*) of Madagascar, noteworthy for the structure of its leaves. The blade resembles latticework or open needlework, the longitudinal ribs being crossed by tendrils, and the interstices between them being open. The root, which is fleshy, and resembles that of the yam, is farinaceous and edible.

LATTIMORE, Samuel Allan, American educator and chemist: b. Union County, Ind., 31 May 1828; d. 17 Feb. 1913. He was graduated at Indiana Asbury (now De Pauw) University in 1850, acted as classical tutor there in 1850–52, and after taking his M.A. in 1853 he was appointed to the chair of Greek. He was professor of chemistry in Genesee College in 1860–67, and in 1867–1908 professor of chemistry at the University of Rochester. He retired in 1908. He was chemist to the New York State Board of Health in 1881–1908, and to the New York State Department of Agriculture in 1886–1908; also serving as chemist to the Rochester board of water commissioners. He was an earnest worker for the exposure of adulteration in food products and did much to popularize, and stimulate interest in, his branch of science. He was active in the establishment of the Western New York Institution for Deaf-Mutes; was a Fellow, and in 1880 vice-president, of the American Association for the Advancement of Science, and was the recipient of several honorary degrees from American universities.

LATTMANN, lät'män, **Julius,** German educator: b. Goslar, 4 March 1818; d. Göttingen, 20 Aug. 1898. He was educated at the University of Göttingen, taught in the gymnasium at Göttingen in 1847–60, and in 1870–90 he was director of the gymnasium at Clausthal. He was deeply interested in theories of linguistic teaching and reforms therein, and wrote a large number of textbooks. Author of 'Kombination der methodischen Principien im lateinischen Unterricht' (1882; 2d ed., 1888); 'Cornelii Nepotis Liber Emendatus et Suppletus' (1880; 8th ed., 1889); 'Ausgleichende Lösung der Reformbewegungen des höheren Schulwesens' (1889), etc.

LAUBAN, lou'bạn, Germany, city in the Prussian province of Silesia, on the river Queis, 38 miles southwest of Liegnitz and 16 miles east of Gorlitz, at a junction of three railway lines. It was founded in the 10th century, was the headquarters of Frederick the Great in 1761 and in 1815 was the last Saxon town to surrender itself to Prussia. It has a town-hall dating from 1541 and a 14th century convent of Saint Magdalene. It was an important town in the league of the six towns of Lusatia. It has oil and flour mills, tobacco and textile manufactories and breweries. Pop., commune, 15,467.

LAUBE, lou'bĕ, **Heinrich,** German novelist and dramatist: b. Sprottau, Silesia, 18 Sept. 1806; d. Vienna, 1 Aug. 1884. He studied theology at Halle and Breslau, and settled in Leipzig in 1832. He engaged in literary work and an active participation in the movement known as «Das junge Deutschland.» His political essays and a series of novels which scored the existing government got him into difficulties, and he was subjected to police surveillance, while his writings were confiscated. He was expelled from Saxony in 1834 and served a nine months' prison sentence in Berlin. Shortly after his marriage he was again imprisoned for a year because of his political sympathies, and in 1839 he returned to Leipzig and entered upon his career as a dramatist and theatre director. He served in the Frankfort National Assembly in 1848–49, resigning in order to accept an appointment as artistic director in the Hofburg Theatre in Vienna. He was director of the Leipzig Stadtheatre in 1869–70, and in 1872 returned to Vienna as head of the new Stadtheatre there, a position he held until his retirement in 1880. He was a master of stage-craft and his work in this field won him higher rank than either his dramas or novels. His dramas are notable particularly for their adaptability for stage reproduction. He wrote several novels and his memoirs after his retirement from public life. Author of the political essays 'Das neue Jahrhundert' (1833); 'Politische Briefe' (1833); a three-volume novel, 'Das junge Europa' (1833–37); the dramas 'Monaldeschi' (1845); 'Gottsched und Gellert' (1847); 'Die Karlsschüler' (1847); 'Graf Essex' (1856); 'Montrose' (1859); the novels 'Der deutsche Krieg' (9 vols., 1865–66); 'Die Böhminger' (1880); 'Louison' (1881); 'Der Schalten-Wilhelm' (1883); a record of his theatrical work in 'Das Burgtheater' (1868); 'Das norddeutsche Theatre' (1872); 'Das weiner Stadtheater' (1875); and 'Erinnerungen, 1841, 1881' (1882). His non-dramatic works were published (16 vols., 1875–82); his dramatic works (13 vols., 1845–75; pop. ed., 10 vols., 1880–92). Consult Proelss, J., 'Das junge Deutschland' (1892); Bulthaupt, H., 'Dramaturgie des Schauspiels' (Vol. III, 6th ed., 1901).

LAUD, lâd, **William**, English prelate: b. Reading, Berkshire, 7 Oct. 1573; d. London, 10 Jan. 1645. He was educated at Saint John's College, Oxford; took priest's orders in 1601; became vicar of Stanford, Northamptonshire, 1607, and rector of West Tilbury, Essex, 1609; was made archdeacon of Huntingdon in 1615 and dean of Gloucester 1616, and as king's chaplain in 1617 accompanied James I to Scotland, where he attempted to enforce Episcopacy with no success. In January 1621 he became a canon of Westminster and in the following June, bishop of Saint David's. After the accession of Charles I, Laud was translated in 1626 to the see of Bath and Wells, and in 1628 to that of London. In 1629 he was elected chancellor of the University of Oxford, which he enriched with a valuable collection of manuscripts, establishing also a professorship of Arabic. In 1633 he was promoted to the see of Canterbury. In 1634 he instituted rigorous proceedings against all who would not conform to the Church of England, and sought to extinguish all forms of dissent by means of fines, imprisonment and exile. When the Long Parliament met (1640) the archbishop was impeached for high treason at the bar of the House of Lords by Denzil Holles and committed to the Tower. After three years he was brought to trial, but the Lords deferred giving judgment. The House of Commons, however, passed a bill of attainder (January 1644), declaring him guilty of high treason, and condemned him to death. He met his end on the scaffold at Tower Hill with great firmness. He was opposed to Rome on the one hand and to Puritanism on the other, laid stress on sacramental grace and apostolic succession and order in public worship, favored a national observance of Sunday, had a high repute for learning, but was tactless in his handling of his opponents. Consult Gardiner, S. R., 'The Personal Government of Charles I' (1871) and 'The Fall of the Monarchy of Charles I' (1881); and 'Lives' by Benson (1887); Hutton (1885); Mackintosh (1907); Simpkinson (1894), and Waterman (1912).

LAUDANUM, lâ'dą-nŭm. See Opium.

LAUDER, Harry (real name **MacLennan**), Scottish singer: b. Portobello, 4 Aug. 1870. He was employed in a flax-spinning mill when a boy and later worked in the coal mines. His natural talent for music and gift for entertaining soon won him considerable reputation as an amateur entertainer and he chose the stage as a profession. His first tours were of Scotland and Ireland, but he appeared in London in the early nineties and speedily became a great favorite. His first tour of the United States was made in 1907 and was phenomenally successful. He toured the country repeatedly afterward, always enthusiastically welcome. He toured Australia and New Zealand in 1914 and returning to England threw himself whole-heartedly into the recruiting service. He organized and personally paid the expenses of a band of Scottish pipers which became famous and himself toured England in the work of recruiting. Later, after many difficulties, he secured government permission to sing on the actual firing line and in the front line trenches in France. While generally regarded as a comedian, his songs and characterizations range from those of rollicking humor to the tenderest tributes to home, love and country. After the death of his only child, Capt. John Lauder, at the front in France 28 Dec. 1916, Lauder for a time refused to return to the stage, but the call was so insistent that he obeyed it. After his first visit to the front he organized the «Harry Lauder Million Pound Fund for Maimed Men, Scottish Soldiers and Sailors.» Lord Roseberry is honorary president of the fund and Lord Balfour is its secretary. The purpose of the fund is to present the maimed soldiers and sailors of Scotland with a sufficient amount to establish them in business or in a suitable calling, not as a charity, but as an acknowledgment of their country's debt. Both words and music of Lauder's songs are his own composition and include many that are widely popular. Among them are 'Roamin' in the Gloamin''; 'Wee Hoose Amang the Heather'; 'She's the Lass for Me'; 'The Laddies Who Fought and Won,' etc. He is author of a Scottish comedy and 'Harry Lauder at Home and on Tour' (1906); 'Harry Lauder's Logic' (1917); 'A Minstrel in France' (1918).

LAUDER, Sir **Thomas Dick**, 7th Baronet of Fountainhall, Haddingtonshire, Scottish author: b. Edinburgh, 1784; d. 29 May 1848. He served in the 79th Regiment (Cameron Highlanders) and succeeded to the baronetcy in 1820. He began his literary career in 1815 with contributions to the *Annals of Philosophy,* published at Glasgow, and in 1817 his story entitled 'Simon Roy Gardener at Dumphail' was published in *Blackwood's Magazine* with the editorial announcement that it was "written, we have no doubt, by the author of Waverley." He continued writing for *Blackwood's* and also for *Tait's Magazine.* He was active in politics; enthusiastically supported the Reform Bill; and in 1839 was appointed to the Board of Scottish Fisheries as secretary, also serving in that capacity for the Board of White Herring Fishery after the consolidation of the two. In his official capacity he devoted much attention to the foundation of technical and art schools. His most important work, from the modern standpoint, is his vivid and sympathetic 'Account of the Great Floods of August 1829 in the Province of Moray and Adjoining Districts' (1830). Author of 'Lochindhu' (1825); 'The Wolf of Badenoch' (1827); 'Highland Rambles and Legends to Shorten the Way' (3 vols., 1837); 'Legends and Tales of the Highlands' (3 vols., 1841), etc.

LAUDER, William, Scottish literary forger: b. latter part of 17th century; d. Barbadoes, 1771. He was educated at Edinburgh University, where he afterward engaged in tutoring. He was an excellent classical scholar and in 1739 published 'Poetarum Scotorum Musae Sacrae' (3 vols.), a collection of poems by various authors, chiefly paraphrased from the Bible, and accompanied by an overlaudatory preface concerning one of the authors, Arthur Johnston. He was unsuccessful in his efforts to secure an appointment at Edinburgh and in 1742 settled in London. In 1747 the first of a series of articles endeavoring to prove Milton a plagiarist appeared in *Blackwood's Magazine,* so cleverly written that men like Dr. Samuel Johnson were for a time inclined to support Lauder in his allegations. He attempted to prove that 'Paradise Lost' was largely composed of plagiarisms from different authors, whom he increased to about a hundred, presenting inaccurate quotations and going so far as to make use of a Latin translation of 'Paradise Lost.' His venture succeeded for a time, but was thoroughly exposed by scholars conversant with the sources from which Lauder supposedly drew his information; and he was finally induced to make a confession, Dr. Johnson taking a leading part in the proceedings. The forgeries are included in 'Essays on Milton's Use and Imitations of the Moderns in his "Paradise Lost"' (1750), and 'The Grand Imposter: or Charles I Vindicated from the Charge of Plagiarism Brought against Him by Milton, and Milton Himself Convicted of Forgery' (1754). Practically forced into exile he went to Barbadoes, where he died.

LAUDERDALE, James Maitland, 8th Earl of, Scottish statesman: b. Ratho, Midlothian, 26 Jan. 1759; d. Thirlestane Castle, Berwickshire, 13 Sept. 1839. He studied at the University of Edinburgh, Trinity College, Oxford and Glasgow University, read law at Lincoln's Inn and in 1780 became a member of the faculty of advocates. He was elected to the House of Commons in 1780 and in 1781 he was an advocate of Fox's demand for a committee on the state of the American War, maintaining that the authors of the war were "no less inimical to the liberties of Great Britain than America." He supported Fox's East India Bill in 1783, and in 1787 was one of the managers of Hasting's impeachment. In 1789 he succeeded to the peerage and was elected a Scottish representative peer. He was in Paris at the time of the attack upon the Tuileries; and later strongly opposed the French War, but without appreciable support from his associates. His continued opposition to the ministry prevented his re-election in 1796 and in 1802, but with the return of the Whigs to power he was in 1806 created a peer of Great Britain and Ireland with the title Baron Lauderdale of Thirlestane, Berwick. He declined the appointment as governor-general of India, but accepted the office of Lord High Keeper of the Great Seal of Scotland and was sworn a member of the Privy Council, 21 July 1806. Upon Lord Grenville's downfall in 1807 he resigned and became an active member of the opposition in the House of Lords. He was leader of the Whig party in Scotland, and received the Order of the Thistle in 1821. He afterward became affiliated with the Tory party and exerted a considerable influence with its leaders. With the Duke of Bedford he attacked the pensioning of Burke, calling forth Burke's famous 'Letter to a Noble Lord' (1796). There are 86 of his protests in 'Journals of the House of Lords,' for which consult Rogers, 'Protests of the House of Lords' (Vols. II and III). He wrote a large number of political pamphlets, and his 'Inquiry into the Nature and Origin of Public Wealth' (1804; enlarged ed., 1819) was translated into Italian and French. Of his political writings the best known is 'Letters to the Peers of Scotland' (1794).

LAUDERDALE, John Maitland, Duke of, Scottish politician: b. Lethington, 24 May 1616; d. 20 or 24 Aug. 1682. He was the eldest surviving son of John, 1st Earl of Lauderdale, and made his entrance into public life as a staunch supporter of the Presbyterian cause. He embraced the Covenant and in 1643 was sent to England as one of the commissioners for the Solemn League and Covenant, later carrying it before the two houses at Westminster. In 1644 he was instrumental in securing the surrender of Charles I, but he afterward espoused the royal cause, and succeeded in obtaining a supreme influence over Charles II. He accompanied Charles II from Holland to Scotland but was taken prisoner at Worcester in 1651 and kept in prison until 1660 when he returned to Charles at Breda and despite opposition was appointed Secretary of State. He triumphed over all his opponents in Scotland, became practical administrator of that kingdom and soon turned against the Covenanters, whom he persecuted mercilessly. Able and unscrupulous, his position as the favorite of Charles enabled him to employ methods which were reminiscent of the scandals and abuses of the Stuart administration before the civil war. He was created Duke of Lauderdale and earl of March in 1672; and in 1674, earl of Guilford and Baron Petersham in the peerage of England, and was made a Privy Councillor of England. His hold upon the king withstood repeated demands of the House of Commons for his removal, and he remained in favor with the monarch until he voted for the execution of Lord Stafford, 29 Nov. 1680. He was then stripped of all his pensions and public offices except that of the life appointment of extraordinary lord of session. His health had already failed and he died in retirement. He left no male issue and his English titles became extinct.

LAUDIAN MANUSCRIPT (Codex Laudianus), manuscript of the Acts of the Apostles presented to the University of Oxford in 1636 by Archbishop Laud and now No. 35 in the Bodleian Library. It is a manuscript of great value and has 226 leaves of from 23 to 26 lines, nine by seven and a half inches in size. The quality of the vellum is poor and the ink is faded. It is written in parallel columns and uncial letters. The Latin words are invariably opposite those of the Greek text and are a closely literal version, not a transcript of either Jerome or the Vulgate. The leaves covering xxvi, 29 — xxvii, 26, are missing. Its origin is fixed at about the 6th century and it was probably written in western Europe. Readings from it were taken by Fell (1675), and Mill (1707). The Hearne edition (1715) is very rare. Later editions are by Hansell (1864), and Tischendorf (1870). Consult Davidson, ‹Biblical Criticism› (Vol. II, p. 293); Gregory, ‹Canon and Text of the New Testament› (1907).

LAUDON, lou'dŏn, or **LOUDON, Gideon Ernst,** Baron von, Austrian general: b. Tootzen, Livonia, 2 Feb. 1717; d. 14 July 1790. He was of Scottish descent and served in the Russian army in 1732–39. He settled in Austria in 1742, became a colonel at the outbreak of the Seven Years War and in the following year was promoted major-general. He fought at Rossbach and Hochkirch, and with the aid of the Russian General Soltikoff defeated the forces of Frederick the Great at Kunersdorf in 1759. He won further victories at Glatz and Landshut, was ennobled in 1758 and became field-marshal in 1778 after service in Bohemia. He fought in the Turkish War of 1788–89, capturing Belgrade, and in 1790 he became generalissimo. Consult Janko, ‹Das Leben des Feldmarshalls von Laudon› (1869).

LAUDONNIÈRE, René de, rĕ-nā dĕ lō-dŏ-nē-ār, French navigator. Nothing is known of the date of his birth or death. His first appearance is in 1562, when he shared in Ribault's attempt to establish a Huguenot colony at Port Royal in South Carolina. He built a fort and founded a colony in 1564 at a point 12 miles up the Saint John's River, Florida. But his colonists were more men of adventure than of industry and were much molested by the Indians. They eventually compelled him to sanction an expedition against the Spaniards in Cuba. But the colony fell subsequently into such straits that 3 Aug. 1565, when Capt. John Hawkins reached Fort Carolina, as they had named their settlement, he found them without supplies or ships. On 29 August, Ribault arrived with seven ships and 300 men, and superseded Laudonnière, who was ordered home to defend himself against charges of treason and tyranny. In Ribault's absence the Spaniards attacked Fort Carolina and massacred the colonists. Laudonnière escaped, took refuge in England and did not return to France till 1566.

LAUENBURG, lou'ĕn-poork, Prussia, town in the province of Pomerania, 38 miles northwest of Danzig and 68 miles northeast of Köslin on the right bank of the Leba River. It has textile and leather manufactories, and also produces matches, stoves, machinery and cement bricks. There is a considerable trade in lumber, wines and live stock. Pop. 13,916.

LAUENBURG, Prussia, administrative circle in the province of Schleswig-Holstein, bordering Hamburg, Lübec, Mechlinburg-Schwerin and Hanover, and bounded on the south by the Elbe River. It has an area of 455 square miles, is well wooded, with a fertile soil, and is principally occupied with agriculture and stock-raising. Its chief towns are Lauenburg and Ratzeburg. Its ancient inhabitants were Polabs and later it formed a part of the duchy of Saxony. It was ruled in succession by the dukes of Saxe-Lauenburg, house of Hanover and the kings of Denmark. It became Prussian in 1866, and in 1890 Bismarck received the title of the Duke of Lauenburg, his largest estate, Friedrichsruh, being located there. Pop. 54,571.

LAUENBURG, Prussia, town in the circle of Lauenburg, Schleswig-Holstein, 26 miles southeast of Hamburg on the Elbe River and Trave Canal. It has a castle built in 1181 by Duke Bernhard of Saxony. The modern town has shipbuilding and manufacturing industries. Pop. 5,178.

LAUFER, lou'fĕr, **Berthold,** American anthropologist and Orientalist: b. Cologne, Germany, 11 Oct. 1874. He was educated at the universities of Berlin and Leipzig, and the Seminary for Oriental Languages, Berlin. He came to United States in 1898, and in 1898–99 he was a member of the Jesup North Pacific expedition to Saghalin Island and the Amur region of eastern Siberia for an ethnological survey. He accompanied the Jacob H. Schiff expedition to China in 1901–04, and the Mrs. T. B. Blackstone expedition to Tibet and China in 1908–10. He was assistant in ethnology at the American Museum of Natural History, New York, in 1904–06; lecturer on anthropology and East Asiatic languages at Columbia University, in 1905 and 1906–07; became assistant curator of Asiatic ethnology at the Field Museum of Natural History, Chicago, in 1911, and curator in 1915. He is a member of the leading scientific societies of America, Europe and Asia. Author of more than 100 scientific papers; and ‹Descriptive Account of the Collections of Chinese, Tibetan, Mongol and Japanese Books in the Newberry Library› (1913).

LAUFF, Joseph von, German poet, novelist and dramatist: b. Cologne, 16 Nov. 1855. He was educated at Münster, Westphalia, entered the army as lieutenant of artillery in 1877 and reached the rank of major in 1898, at the same time being summoned to Wiesbaden by William II and ordered to devote his dramatic gifts to the Royal Theatre. His earliest literary work took the form of epic poems, of which the first was published in 1886. He later wrote several novels which enjoyed a considerable success, but he found his greatest rewards in the writing of dramas. He was ennobled in 1913. Author of the epic poems 'Jan Van Calker, ein Malerlied vom Niederrheim' (1887; 3d ed., 1892); 'Der Helfensteiner, ein Sang aus dem Bauernkriege' (1889; 3d ed., 1896); 'Die Overstolzin' (1891; 5th ed., 1900); 'Herodias' (1897; 2d ed., 1898); 'Geislerin' (1900; 4th ed., 1902); the novels 'Die Hexe' (1892; 6th ed., 1900); 'Regina coeli' (1894; 7th ed., 1904); 'Die Hauptmannsfrau' (1895; 8th ed., 1913); 'Marie Verwahnen' (1903); the dramas 'Ignez de Castro' (1894); a Hohenzollern tetralogy, 'Der Burggraf' (1897); 'Der Eisenzahn' (1900); 'Der Grosse Kürfurst' (1900); 'Friedrich der Grosse, Vörwarts' (1900); 'Rüschhaus' (1900); 'Heerhom' (1902), etc.

LAUGÉE, lō'zhā, **Désiré François**, French painter: b. Maromme, 25 Jan. 1823; d. Paris, 24 Jan. 1896. He studied under Picot and at the École des Beaux-Arts, and first exhibited in the Salon in 1845. His work covers portraits, historical, genre and religious paintings. Among his paintings are 'Van Dyck à Savelthem et la Mort de Zurbaran' (1850); 'Leseur chez les chartruex' (1855); 'Sainte Élisabeth de France lavant les pieds des pauvres' (1865); mural paintings in the church of Saint Clotilde, Paris (1870); a decorative painting, 'Le Triomphe de Flore' in the Hotel Continental (1879); 'Victor Hugo sur son lit de mort' (1880); 'Les Approches de l'automne' (1892); 'Le Fil de la Vierge' (1893), etc. Examples of his work may be found in the museums of Amiens, Lille and Luxembourg.

LAUGÉE, Georges, French painter: b. Montvilliers, 19 Dec. 1853. He studied under his father, Désiré François Laugée (q.v.), and under Pils and Lehman, and made his first exhibition in the Salon in 1877. His work is chiefly of the genre type. His paintings include 'Le Repas des Moissoneurs' (1877); 'Arracheuses de betteraves en Picardie' (1879); 'En Octobre' (1881); 'Soliel Couchant' (1886); 'Au printemps de lavie' (1891); 'Au pays normand et les Lapins' (1894), etc.

LAUGHING GAS, a name given to nitrous oxide after its remarkable physiological effects were discovered by Sir Humphry Davy in his 'Researches,' published in 1800. The effects are generally of a pleasurable kind and the person under the influence of the gas is more or less excited, dancing, singing, laughing or indulging in other violent motions. This by prolonged inhalation ceases and stupor and anæsthesia, or insensibility to pain, supervene. Hence the use of this gas in dental and surgical operations. See ANÆSTHETICS; NITROUS OXIDE.

LAUGHING GULL, black-hooded gull of the North American coasts (*larus atricilla*), which migrates to the Amazon in winter. It is between 15 and 17 inches in length, has a mantle of slate-gray with white beneath, and in breeding season the hood, or capistrum, is nearly black. Its popular name comes from its peculiar cry which resembles boisterous laughter. It nests on sandy inlets from Florida to Maine, building a carefully-constructed nest of seaweed and grasses on the ground. The European species (*larus ridibundus*) is similar in character except that it is smaller in size. Both species are very numerous.

LAUGHING PHILOSOPHER, a characterization of Democritus of Miletus (q.v.). He laughed at the follies of man and is distinguished by this epithet from the "weeping philosopher," Heraclitus, who mourned for human depravity and infatuation.

LAUGHLIN, lăf'lĭn, **James Laurence**, American political economist and educator: b. Deerfield, Ohio, 2 April 1850. He was graduated from Harvard in 1873. In 1878 was appointed instructor of political economy there and was assistant professor 1883–87. From 1887 to 1890 he was president of the Manufacturers' Mutual Insurance Company of Philadelphia; in 1890–92 professor of political economy at Cornell; and in 1892 became head professor of the same department in Chicago University. In later years he has given special attention to the study of financial questions; in 1894–95 he prepared a scheme of monetary reform for the San Domingo government which was later adopted; and he has been a member of the monetary commission created by the Indianapolis Monetary Conference in 1897. He is a member of the International Institute of Statistics and of the Political Economy Club, of which he was one of the founders. He has written 'Anglo-Saxon Legal Procedure in Anglo-Saxon Laws' (1876); 'Study of Political Economy' (1885); 'History of Bimetellism' (1886), a comprehensive treatment of the subject; 'Elements of Political Economy' (1887); 'Gold Prices since 1873' (1887); 'Facts about Money' (1895); 'Report of Monetary Commission' (1898); 'Principles of Money' (1902); 'Reciprocity' (1903); 'Industrial America' (1906); 'Aus dem Amerikanischen Wirtschaftsleben' (1907); 'Latter-Day Problems' (1909); and has prepared an abridged edition of Mill's 'Principles of Political Economy' (1884) with a short biography and a sketch of the history of political economy. He was editor of the *Journal of Political Economy*, and was one of the founders of the *Quarterly Journal of Economics*, to which he has contributed frequently.

LAUGHTER, in physiological-psychology, an expression of emotion, consisting chiefly in certain convulsive and partly involuntary activities of the muscles of respiration by means of which after an inspiration the explosion of air from the lungs in a series of interruptions produces a succession of short abrupt movements of the muscles of the face and often of other parts of the body, along with an emission of chuckling sounds from the throat. It is usually accompanied by a peculiar expression of the eyes, indicating merriment, keen amusement, satisfaction or derision; and even sometimes by tears. A gentle and inaudible form of laughter is called a smile. It is expressed merely in the movement of the lips and eyes. Dr. Boris Sidis discovered in the course of his investigations of the causes of laughter the primary law that "all unrestrained activities of normal functions give rise to the emotion of joy with its expressions of smiles and laughter"; and with this as the initial point of his discussion, he begins with a consideration of the "play-instinct" in all young animals. Upon this hypothesis Dr. Sidis builds up a tolerably convincing theory that very nearly all human activity is based upon the "play-instinct." Widely differing human activities — church ceremonies, theatricals, outdoor games — contends Dr. Sidis, are at bottom things which subserve the same function. All satisfy the play-instinct. "Laughter, smiling, grinning, are all external manifestations of the play instinct" (Dr. Sidis). In all he perceives expressions either of satisfaction, derision, contentment or inner emotion of joy — and they all accompany the play-instinct. Thus church services and a football game become inwardly connected. From the coarse roar of an amused mob enjoying to the full the laughter induced by suffering(!), we reach, after gradation upon gradation, the inner glow of the human soul, a glow which comes to all reverent worshippers of the divine; and the ultimate, supreme manifestation of joy expressed outwardly only by a rapt expression of the countenance or by the gleam in the eye, it is yet none the less of the very essence of laughter. Laughing is the privilege of man. It is the outburst of sentiment. Yet it is limited to the domain of rational mentality.

Homer tells us that the followers of Ulysses died with laughter at the sight of Irus writhing in anguish on the ground after Ulysses had broken his skull. Sir Thomas Urquhart is said to have died in a paroxysm of laughter, on hearing of the restoration of Charles II; a statement which is rendered sufficiently probable by the record of similar cases and by the eccentric character of the individuals said so to have died. Aretæus, an ancient physician, specifies unextinguishable laughter as one of the causes of death. And other ancient writers have mentioned the names of different persons who died of excessive joy. According to the common account, even Sophocles was among this number.

John Kendrick Bangs has pointed out that the conclusion that laughter is necessarily sardonic would be a half-truth only. Yet he admits that he who endeavored to trace the causes of laughter, induced by a Broadway librettist, would find himself inevitably enmeshed in a miasmatic ooze emanating from the emotional morasses of an unspiritual bedlam. The only common element in both the mirth described by Homer and in the case just mentioned seems to him a sort of unwitting cruelty. "The highest point reached by laughter," says Dr. Sidis on the other hand, "is intimately related to the highest intellectual, esthetic and moral development of man." These words recall the statement of Addison, that it annoyed him to see the talents of humor and ridicule in the hands of an ill-natured man. The better of our professional humorists remember this. They know that ridicule and social decadence are capable of mutual understanding, and therefore keep them apart. Professional humor never forgets that to laugh *with* and not *at* people is the mission of him who would work great ends through the laughter of sympathy. They never stoop willingly to the caustic ridicule which leaves behind it the sting of resentment and the scar of injury and injustice. (J. K. Bangs).

They teach us to laugh aright. They discover for us relationships where they are least expected, and the reaction is laughter. Or they show us how relationships appearing to exist are preposterous, which being done suddenly we laugh. The expression of laughter is not always indicative of a physical appreciation of enjoyment, for it is well known that idiots are prone to laughter which is often without any such significance. Many idiots constantly show a laughing countenance, the smile being more or less stereotyped; or they may grin, giggle or chuckle at the slightest stimulus, whether of food, color, music or personal contact. It is probable that in such cases laughter is purely an expression of physical contentment, rarely associated with higher or more complex ideas.

In children, laughter is more sensible, but the expressions of joy usually contain an element of uncontrolled exuberance. Thus they clap their hands, stamp their feet and jump around in pure excess of vital spirits. In adults the subject of laughter is extremely complex. As a rule, during laughter, the mouth is more or less open, the corners being drawn backward and usually somewhat upward. The upper lip is commonly raised. The drawing-back movement is seen best in the broad smile or in moderate laughter; in out-and-out mirth the teeth are usually exposed by the raising of the upper lip. The cheeks are ordinarily drawn upward at the same time and wrinkles are formed under the eyes. This movement in old persons makes a very characteristic feature, and the wrinkles so frequently found in their faces largely assist to interpret the sense of contentment indicated. Associated with laughter, there is often a change in the character of the eye. The bright and sparkling eye described by Darwin and others who have devoted much time to this subject is the eye of laughter. Often tears suffuse the eyes and destroy this appearance of brightness, but this is usually due to excessive laughter.

Numerous signs are produced during these expressions of joy. During laughter, the movements of the chest and larynx are almost exactly opposite to those that accompany the screams and cries of distress. In these latter the expirations are prolonged and continuous, and the inspirations short and interrupted; whereas in joy the expirations are usually short and the inspirations long.

"In all races of men," says Darwin, "the expression of good spirits seems to be the same, and it is easily recognized"; and he adds that "from the natives of New Zealand to the highly civilized Caucasian, much the same forms of emotional expression are to be observed." Laughter is often an indication of general character; it is seldom two persons laugh exactly alike; and the study of laughter becomes a study of muscular movements. The "spontaneous, hearty laughter of sincere feeling is very different from the affected and constrained laughter of insanity." Moreover, there are laughs which betoken peculiar constitutions of mind and character; laughs that are mechanical, nervous spasms, expressing nothing and expressed when there is nothing to laugh at, or perhaps something not to laugh at; laughs which, when they have not been acquired and are unconsciously formed, are signs of neurotic instability, but sure signs of guile when they are affected and consciously used — untrustworthy, anyhow, as laughter. Maudsley describes what he terms a "*quasi*-pathological laugh," which is the abortive and incoherent laugh of the person of insane temperament, which is laughter pulled up abruptly, followed by a sudden facial seriousness or a change which affects only a part of the features, while the rest are unmoved. Consult Bergson, Henri, 'Laughter' (New York 1912); Darwin, 'Expression of the Emotions in Man and Animals' (latest ed., New York 1910); Hughes, 'Die Mimik des Menschen' (1900); and Sidis, B., the 'Psychology of Laughter' (New York 1913); Sully, James, 'An Essay on Laughter' (ib. 1902).

LAUGHTON, lä'tŏn, Sir **John Knox,** British naval officer and historian: b. Liverpool, 23 April 1830; d. 14 Sept. 1915. He served in the Baltic during the Russian War, 1854, and in China from 1856–59. He was mathematical and naval instructor in the Royal Naval College, Portsmouth, 1866–73 (afterward holding the same post at Greenwich); and was lecturer on naval history, 1876–89. In 1885 he was appointed professor of modern history in King's College, London. He was the author of 'Physical Geography in its Relation to Prevailing Winds and Currents' (1870); 'Treatise on Nautical Surveying' (1872); 'Studies in Naval History' (1887); 'Nelson and his Companions in Arms' (1896), etc. He was the founder of the Navy Records Society, for which he edited some important publications, and he contributed largely to the 'Dictionary of National Biography.'

LAUGIER, lō'zhyā, **Paul Auguste Ernest,** French astronomer: b. Paris, 1812; d. 1872. He studied at the Polytechnique and at the Paris Observatory under Arago. In 1843 he was elected to the Academy of Sciences, and was afterward attached to the Bureau of Longitudes. He was favorably known for his work on the subjects of solar equator and sun-spots.

LAUMONTITE, lâ'mȯn-tīt, one of the zeolite family of minerals. It usually occurs in masses made up of white, vitreous to pearly, monoclinic prisms. It is a hydrous silicate of aluminium and calcium, $H_4CaAl_2Si_4O_{14} + 2H_2O$. Upon exposure the normally colorless and transparent crystals quickly lose part of their water of crystallization and become white, opaque, brittle and much below the normal hardness of 3.5 to 4. Laumontite is rarer than most of the zeolites with which it is associated in many localities. Especially fine specimens are found at Nagyag, Tansylvania, in Nova Scotia, New Jersey, Lake Superior, etc.

LAUNCESTON, läns'tȯn, England, a borough and market town in the county of Cornwall, 24 miles north by west of Plymouth, and on the river Kensey near its confluence with the Attery and Tamar. It is situated on the side of a hill, is generally well built, and has a fine church, built of granite in the 16th century in a debased perpendicular style and occupying the site of an older building of which a detached tower remains of date 1380; a guildhall in castellated style; a town-hall (1887), and a grammar school founded in the reign of Edward VI. There are the ruins of the old castle, the seat of the earls of Cornwall, in which George Fox the Quaker was imprisoned in 1656 for distributing tracts, and of a fine priory. A fine Norman doorway is to be seen in the White Hart Hotel. Agriculture, tanning and iron-founding are the chief employments. This town was until 1838 the capital of Cornwall; but Bodmin is now the assize town. It gives name to one of the six parliamentary divisions of the county. Pop. 4,117.

LAUNCESTON, Tasmania, the second city in the island, in the county of Cornwall, 133 miles, by rail, north of Hobart, at the confluence of the North and South Esk rivers, the united stream taking after this the name of the Tamar, which is navigable up to the town from the sea, a distance of 40 miles. With the floating dock access is readily obtained by vessels of large tonnage. The streets are regularly laid out and lighted by electricity. The principal buildings are the town-hall; the Albert Hall; the mechanics' institute, with library; technical schools and school of mines; and art gallery. Wheat, oats, peas and potatoes are the chief crops grown in the neighborhood, but fruit culture is steadily extending, and gold, oil, hardwood and bark are also exported. Launceston is the seat of a United States consular agent. Pop., with suburbs, 23,726.

LAUNCH, in shipbuilding, a term comprehending the apparatus for removing a vessel from the land to the water. The keel of a ship is laid upon a series of blocks, placed six or seven feet apart, the tops of which lie in a line which slopes downward to the water at an angle of about five-eighths of an inch to the foot. Timber shores on either side support the vessel in an upright position upon the keel blocks. When ready for launching "ways" of planking are laid parallel to the keel under the bilges of the ship and extending into the water a considerable distance. A cradle is now built under the ship, with its bottom resting on the ways. Just before launching the keel blocks are lowered away or otherwise removed, transferring the weight of the ship to the cradle and ways. Dogshores are put in place to prevent the ship from sliding down until the right moment. When the time arrives the dogshores are removed and the vessel begins to slide, at first slowly, downward, the cradle slipping along the ways and breaking into pieces as soon as the water takes the weight of the vessel from it. Some vessels are built in dry dock and are floated out when ready. Hydraulic machinery of a special type is used to insure the cradle starting on the ways.

LAUNCH, the largest boat belonging to a ship of war. It is only used for service which cannot be performed by the smaller boats. There are steam, motor and sailing launches. In large men-of-war launches 40 to 60 feet long are carried. They are used as picket boats to guard against surprise by torpedo or other craft, and some are capable of steaming 18 or 19 knots. Two types of sailing launch are supplied to vessels of the United States navy — one propelled by oars or sails and the other by gasoline or heavy-oil engines. The latter is from 32 to 45 feet long, has a speed of five to eight knots and is much used in carrying men and stores to and from ships. The corresponding boat of merchant vessels is called the long boat.

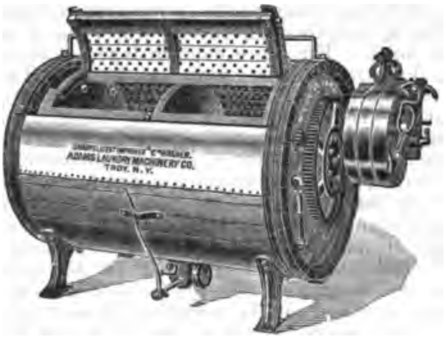
LAUNDER, in mining, a water-gutter, conduit, pipe or trough, usually of wood, for conveying water to a stamp-mill or other hydraulic apparatus for comminuting or sorting ore. Also a trough or box to receive the slimes from the stamps.

LAUNDRY MACHINERY. Laundry machinery as it is understood from the commercial standpoint includes a class of mechanical devices developed during a comparatively recent period, to supplant the primitive processes of laundering that have existed during all time. While the use of laundry machinery in crude forms dates back for a considerable period, the past three or four decades mark the era of the development and manufacture of power machinery for laundering purposes, in a sufficient degree to warrant recognition as an independent branch of industry. This is due to the fact that the steam laundry is a modern institution; and the development and extent of manufacture of laundry machinery has gone hand in hand with the growth of the laundry interest. The steam laundry of to-day performs on a large scale, and by improved mechanical devices, the processes of cleansing, that for centuries had been confined to hand work in connection with the running stream, or the wash tub of later years. The growth of the laundry as an organized business has been so rapid during the past quarter of a century that its changing needs have made, and still keep, the invention and production of laundry machinery in a state of constant development of new ideas and forms. So that while the laundry machinery business has passed the embryotic stage, it may fairly be said in the opening years of the 20th century to be in an era of great advance, holding and to hold a much more important position as an independent and recognized branch of mechanical industry. The city of Troy, N. Y. (the birthplace of the collar, cuff and shirt industry, as set forth in an article under that head) was practically the home, and for many years was the centre, of the steam laundry interests of the country; an interest which has now extended to every city or place of any importance in the land. So general is the recognition of this fact, that the name «Troy Laundry» is still retained by hundreds of laundries in various parts of the United States, and is even seen abroad. It was natural, therefore, that the earliest organized movement to produce the machines demanded for laundering purposes should have been made in Troy. That city has always been and still remains a strong factor in the laundry machinery industry, which, however, with its diversified and growing interests is now located and strongly intrenched in various sections. All the manufactories of laundry machinery are, however, located east of the Mississippi River.

The introduction, use and development of laundry machinery has been much more rapid and general in the United States than in Europe. American manufacturers are competing actively for the trade of all foreign markets. The greatest limitation to the development of the trade abroad is the conservatism of foreign nations in adopting the more advanced methods of laundering calling for the modern types of American machinery. While there are very many forms of laundry machinery in use, the most prominent examples of the art are included in those that perform the three most important functions of laundering, namely, washing, drying and ironing.

Washing Machines.— The first process, washing, is performed by two types of rotary machines, the dash wheel and the reverse wheel. The dash wheel consists of a large cylinder divided into pockets by baffles and revolving in one direction inside of an outer case. This machine is used principally in new work laundries. The more generally used washer is the reverse wheel. In this the goods are placed in an inside cylinder having perforations to admit the free passage of water, steam and soap among the goods. This cylinder runs in an outside shell or case, the water and steam being let in by pipes, and by automatic reversing devices the inside cylinder revolves several times in one direction, then an equal number in the opposite one. This action loosens up the goods and subjects them freely to the action of water and soap, and so removes the dirt from the garments. The inside cylinders are made of wood and brass and the outside cases of wood, galvanized iron or brass. Another form of the interior cylinder has its sides of copper rods with sufficient space between to allow the free entrance of the hot soapy liquid in the outer case. An improved and very efficient type of this machine has the inner cylinder pivoted off the centre, with the result that the cleansing liquid is scooped up by the revolving eccentric and surges through the «wash» as it falls back to the bottom of the case. These washing machines are made in several sizes, graded to the economical performance of the work they are expected to do. They may be had either for the ordinary laundry work at low pressure, or with steam-tight covers and connections to support the high steam pressures used particularly for sterilizing or disinfecting. A different type of washer is used in washing flannels and other woolens, for which the temperatures must be much lower, the revolving motion slower, and the baffles and paddles arranged to produce a kneading effect. The operations of rinsing and blueing are carried out in the same machines in which the washing is done.

Drying Machinery.— The next process is that of drying. The goods are first taken from the washer and placed in what is known as a centrifugal extractor. This machine consists of a perforated copper basket, revolving rapidly inside an iron or steel curl or case, and making from 800 to 1,400 revolutions per minute. The water is thrown out through the perforations in the basket by centrifugal force, and in about 20 minutes the goods are partially dried and ready to be taken out. The drying process is completed by the use of a dry-room. The


ADAMS LAUNDRY MACHINERY CO.
TROY, N. Y.

improved types include the cabinet room, made up of a series of racks or trucks arranged with bars or hooks to hold the collars, cuffs, shirts or other garments, and running on tracks into a cabinet made of wood or metal. The heat is supplied by a series of steam coils arranged horizontally or longitudinally in the room, and often heated by the waste wash water. Fans are used to circulate the heat among the goods and accelerate the drying process. The most recent development is the automatic dry-room. In this the goods are hung on hooks attached to an endless chain or wire cable, which enters into and passes through the room in a series of loops, and out at the other end of the room. The goods are dried in one journey and are removed from the hooks by an automatic device so that they fall into baskets on the outside of the room.

Ironing Machinery.— The third general division of laundry work is the ironing, for which many forms and styles of machines are used. For collars and cuffs, it is done on machines consisting of a combination of revolving covered drums coming in contact with revolving heated rolls, the goods being ironed as they pass through. The covered drum is wound with layers of felt, cotton flannel and muslin, forming a padding much the nature of that which covered the old-fashioned family ironing board. The heated rolls are highly polished and are heated by gas or steam. Formerly all these machines required the goods to be passed through several times for a perfect finish. The more modern types of ironers are known as «one pass machines.» These have a series of heated rolls and drums so that the collar is put in at the front of the machine and comes out at the back perfectly ironed. Some of these ironing machines of modern production have a capacity of from 250 to 300 dozen collars or cuffs per hour. The length of the ironing surface of the heated rolls of collar and cuff ironing machines of different sizes varies from 12 to 48 inches. For the ironing of flat pieces such as sheets, table linen and towels, a machine known as the mangle is used, by which the goods are dried on revolving cylinders heated by steam. In the recent types of mangles great capacity is attained; in some the length of ironing surface reaches 10 feet and requires several operators to feed the machine. For shirts, a separate class of ironers is required. These are the bosom, body, sleeve and band ironers. The general principle and operation are, however, the same as in the collar and cuff ironers, previously described. The most recent development of shirt ironing machinery is a series of machines steam heated, and on which the finish is produced by pressing instead of ironing. Flannels are pressed on a hollow table having a perforated surface through which steam comes up in sufficient amount to dampen the goods. Special padded forms of various shapes are employed in the pressing of ladies shirtwaists and fancy skirts.

Other important machines not described above and which are used in laundering are starchers, shapers and dampeners. There are many other forms of laundry machinery made to cover parts of processes, and new forms and types are constantly being invented and put on the market. The special census of manufactures taken in the United States in the year 1914 reported a total of 6,097 power laundries of factory grade, operating machines aggregating 174,881 horse power. These establishments employed 130,641 wage-earners who received annually a total of $59,483,000 in wages. The capital invested amounted to $98,055,000, and the amount received for the work done was $142,503,000. Consult Rothery, G. C., and Edmonds, H. O., ‹The Modern Laundry› (London 1909).

John T. Birge,
Vice-President and Treasurer, Adams Laundry Machinery Company.

LAUNE, lōn, or **LAULNE, Etienne de,** or **DELAUNE,** French engraver: b. Paris or Orléans, 1518; d. Strassburg, 1595. He was by trade a goldsmith and medallist, but is said to have had lessons from Benvenuto Cellini, and from 1561 appears to have devoted himself to engraving. Political affairs caused him to leave France, and the later part of his life was spent at Augsburg and Strassburg. His finest work is shown in his small prints, some of which may be seen at the Louvre. They are for the most part designs for coins, and for goldsmith's and armorer's work. His larger prints are not important.

LAUNFAL, Sir, knight of the Round Table and steward to King Arthur. He is celebrated in James Russell Lowell's ‹Vision of Sir Launfel› and his story more fully told by Thomas Chestre in ‹Sir Launfal.› Tryamour, the sweetheart of Sir Launfal, supplied him with a never-failing purse and promised to appear to him when he was alone. His loyalty to her incensed Queen Guinevere, daughter of the king of Ireland, whom Sir Launfal declared to be unworthy to kiss Tryamour's feet. Imprisoned by King Arthur and threatened with death unless he could prove his assertion, Sir Launfal is rescued and freed by the appearance of Tryamour. The two then journeyed to the isle of Oleron and were seen no more.

LAUNITZ, lou'nĭts, **Robert Eberhard,** Russian-American sculptor: b. Riga, Russia, 1806; d. New York, 1870. He studied under Thorwaldsen in Rome; emigrated to America in 1828, and in 1833 became a member of the National Academy. Among his works are the Pulaski monument at Savannah, Ga., and the battle monument at Frankfort, Ky.

LAUNITZ, Vladimir von der, Russian soldier and government official: d. Saint Petersburg, 3 Jan. 1907. He served in the Turkish

War of 1887–88, was governor of Tamboy for three years, and in 1906 was appointed prefect of police at Saint Petersburg. He was particularly severe in his suppression of revolutionary tendencies, and after the assassination of Gen. Count Alexis Ignatieff, 22 Dec. 1906, and the attempt to kill Vice-Admiral Dubassoff he redoubled his efforts. His published report showed the arrest in Saint Petersburg of 588 persons, accused of revolutionary agitation, in the three days 25–27 Dec. 1906. He was shot and killed at the Institute of Experimental Medicine, Saint Petersburg, 3 Jan. 1907, the assassin himself being immediately afterward shot by an officer who was present.

LAUPEN, low-pĕn, town in canton of Bern, Switzerland, situated at the junction of the Sense and Saane, 10 miles west-southwest of Bern. It was the scene of a victory of Bern over Fribourg and allies in 1339. Pop. about 1,000.

LAURA, the French lady celebrated by Petrarch as the object of his lifelong passion: b. Eaumont, Provence, 1308; d. Avignon, 6 April 1348. Petrarch (q.v.) has told us that he saw her for the first time in the church of Santa Chiara at Avignon, on Good Friday, 6 April 1327; that she was the mother of several children and died on Good Friday at the hour in which he had first seen her, and was the same evening laid to rest in the Franciscan church. It would appear that Laura was the daughter of Audibert de Noyes and was married to Hugo de Sade and bore him 11 children. There is no ground for supposing that Laura was a mere creature of the poet's fancy. Consult Minich, 'Sulla Persona della Celebre Laura,' in 'Atti dell Instituto Veneto' (Vol. IV, series 5, 1877–78); D'Ovidio, 'Madonna Laura' (in the 'Nuova Antologia,' 15 July and 1 Aug. 1888).

LAURA, a small monastic community, such as was common in Egypt, Palestine and Syria. It formed a mean between the solitude of the hermitage and the community life of the mediæval monastery. There was a superior, but no very definite rules. The cells were separately clustered like an encampment round the chapel. The brethren only met together twice a week and subsisted on bread and water. Three monks occupied one cell, under Pachomius. A famous laura was founded by Chariton, a hermit, at Pharan near Jerusalem, one by Saint Euthymius several leagues from Jerusalem, and others in the 5th century by Sabas, a celebrated hermit. The Empress Eudocia, wife of Theodosius II, also instituted a laura. Consult Genier, R., 'Vie de Saint Euthyme le Grand, 377–473' and 'Le moines et l'église en Palestine au Ve siècle' (Paris 1909).

LAURACEÆ. See LAUREL.

LAURANA, lou-rā'nạ, **Luciano da**, Italian architect: b. Dalmatia, 15th century. He is supposed to have been a pupil of Brunelleschi, and among his own pupils was Bramante (q.v.). He designed the ducal palaces at Urbino and Gubbio for Federigo of Urbino, between the years 1468–82. His work is characterized by strength and simplicity of line and splendid proportions, and he is considered without a rival in his period.

LAUREL, lâ'rĕl, Miss., city and county-seat of Jones County, on the Gulf and Ship Island, the Mobile, Jackson and Kansas City and the Queen and Crescent railroads, 110 miles northwest of Mobile. In 1890 this was a village of 100 people, while in 1910 it had 8,465 population. The town owes its beginning to the sawmills of Eastman, Gardiner & Company, and of the Kingston Lumber Company. These sawmills have timber sufficient to last them at least 25 years. Laurel has the following important industries in addition to its sawmills: Laurel Cotton Mill, having 10,000 spindles and 640 looms, and employing 400 hands; Laurel Oil & Fertilizer Company, using 40 tons of cotton seed daily; Lindsey Wagon Company; Brick & Tile Company, having a capacity of 30,000 bricks per day, and Mississippi Knitting Mills, with a capacity of 125 pairs of hose per day. It also has many smaller factories, as a machine shop, railroad repair shops, foundry, cotton compress, ice factory and electric-light and power plant. The town has two national banks. It contains a fine city hall building and the State Agricultural Farm. The waterworks are operated and owned by the municipality. Laurel has adopted the commission form of government. Pop. 10,711.

LAUREL, a tree or shrub of the family *Lauraceæ*, having alternate, simple, often evergreen, exstipulate leaves; panicles or umbels of perfect flowers and one-seeded drupes or berries. The species, of which there are more than 1,000, mostly tropical, are divided into about 40 genera and are most largely represented in Brazil and southwestern Asia. Among the best-known North American members are the red bay (*Persea borbonia*), sassafras (*Sassafras sassafras*), pond spice (*Litsea geniculata*), and wild allspice (*Benzoin benzoin*), all of which are found east of the Mississippi. The tropical species are, however, more important. Among them are avocado or alligator pear (*Persea gratissima*), cinnamon, camphor-tree and cassia (*Cinnamomum*), and greenheart (*Nectandra rodiæ*). The name is usually restricted, however, to the two trees of the type genus *Laurus*, which are natives of the Mediterranean region, and are characterized by dark, evergreen leaves, small, diœcious or perfect inconspicuous flowers in little axillary umbels and small, succulent, purple, cherry-like berries. They sometimes attain heights exceeding 50 feet, but are usually scarcely more than a third of this height. The more popular species is the poet's or wreath laurel (*L. nobilis*), called in America sweet-bay. See BAY.

Among the numerous other shrubs known as laurels are the mountain-laurel (q.v.) and other species of *Kalmia*, the Portugal laurel (*Prunus lusitanica*), the cherry-laurel (*Prunus laurocerasus* and *P. caroliniana*), and the ground-laurel (*Epigæa repens*), better known as "trailing arbutus."

LAUREL IN ART AND SYMBOLISM. The laurel was dedicated by the ancients to Apollo. The very earliest belief of the mysterious virtues of the laurel was that it had purifying qualities. Ancient writers say that Apollo purified himself with laurel after slaying Python, the snake monster who was making

Parnassus (near Delphi), home of the oracle, inaccessible. And every eighth year Delphi commemorated this purification of the god by a festival; hence laurel is said to have been used by the ancients for purification from evil consequences that might follow through the slaying of a living animal. The laurel tree was supposed to be inhabited by spirits — this belief and that of purifying influences may have arisen from the fable that Diana (Artemis), the virgin goddess, guarded the purity of her nymphs with great jealousy, and when Daphne offended she was turned into a laurel tree. Hence the ancient terming of the laurel plant *Daphnē*. In depictions Apollo frequently figures in purification ceremonies and the laurel accompanies the rite. An ancient writer says that during a pestilence at Miletus, Branchis, the founder of the oracle there, sprinkled the people with laurel leaves and purified them. Of a certain priestess (Gaia) we read that in delivering Apollo's oracles she «regularly chewed laurel and fumigated herself with it» before giving her responses. Now, Asclepius, or Æsculapius, was a son of Apollo and the laurel was made also sacred to him as well as his paternal god (this besides the better-known serpent emblem on his staff, also borrowed from Apollo). And, as Æsculapius was master of the mysteries of the therapeutic values of the vegetable kingdom (taught him by physician Chiron), the connection between the laurel's medicinal values and the persons of Apollo and Æsculapius in the minds of the ancient classic pagans becomes clear. But both Apollo and his son were close patron gods of the oracles, hence their symbolic presentment, the laurel, became the attribute of divination and poetry. The poet Hesiod relates how the Muses (Apollo, as Musagetēs, was their leader) put into his hands a branch of laurel and immediately he became a poet. We are told that the guests at feasts who did not know how to play the lyre, recite rhapsodies or poems and could not sing acquired the necessary talent when holding a branch of myrtle or laurel in the hand. The laurel which the diviners carried in the hand they termed *ithynterium* and those who chewed its leaves for purposes of divination were known as *daphnefagi*. It was but a short step from the carrying of laurel for purpose of inspiration to the crowning of the inspired with laurel, and the laurel wreath evolved into a symbol of fame in poetry and the arts of the Muses. Thus we soon see Clio, Muse of History, wearing a wreath of laurel; Calliopē, Muse of Heroic Poems, gets laurel woven into her wreath; Melpomene, Muse of Tragedy, although often crowned with cypress, also is seen frequently with a laurel wreath; Thalia, Muse of Comedy, has a laurel wreath as attribute; Polymnia wears a laurel wreath; Terpsichore and Erato are generally so crowned. But their relationship to Apollo permits each of the group a right to the laurel emblem. By some means the before-mentioned connection of spirits with the laurel tree appears to have brought it into contact with the underworld, for we find (in magic) Medea, as a witch, had twigs of laurel in classic art. Leaving the realm of the Muses, the laurel wreath as emblem of fame of the art gifted reached later to the brow of the successful competitor in Grecian athletics; and thence it was but a short step to the brow of the conqueror in battle and the Roman emperor. And the pupils of Æsculapius, who had been prescribing laurel medicinally as cure for «fever, convulsions, the afflictions of lethargy, headache and coughs,» naturally assumed the emblem. Young doctors were decorated with laurel branches (having *berries* on them) — whence is said to be derived the term «baccalaureatus.» The person crowned with laurel was called «laureatus.» The origin of the English poet-laureate title is obscure. There was a king's poet (*Versificator Regis*) in the reign of Henry III (13th century), but Chaucer, on his return from abroad, assumed the title of poet-laureate, and obtained an annual allowance of wine from 1389. Edmund Spenser (died 1599) is generally considered as the first of the officially appointed line of poet-laureates, which have been continued down to our present day. As a decorative art motif the laurel was used by the ancient Greeks and Romans. In copying the classic arts the French styles Louis XIV and Empire, of course, used the laurel liberally as one of their favorite decorative elements. In wreaths, borders and other uses, the laurel is retained in art of recent times.

Clement W. Coumbe.

LAUREL HILL, Pa., long range of the Alleghany Mountains, forming a boundary between Somerset County on the east and Fayette and Westmoreland counties on the west, and extending from Cambria and Indiana counties into West Virginia, where it is named Chestnut Ridge. Its altitude is above 2,000 feet. The ridge has rich deposits of coal.

LAUREL-MAGNOLIA, the sweet-bay. See Bay.

LAUREL WATER, or CHERRY-LAUREL WATER, liquid distilled from the leaves of the cherry-laurel and water. It standardizes to 1 per cent of hydrocyanic acid and constitutes a powerful poison. It is used as a flavoring for medicines, and as a sedative and narcotic. It has been used ignorantly as a flavoring in cooking with fatal results.

LAUREMBERG, lou'rĕm'bĕrk, **Johann,** German satirist: b. Rostock, 26 Feb. 1590; d. Soröe, Denmark, 28 Feb. 1658. He studied medicine at Paris and Rheims, traveled extensively in England and on the Continent, and in 1618 was appointed professor of poetry at Rostock. He became professor of mathematics at the Ritterakademie at Soröe in 1623 and remained there until his death. His use of the Low German dialect mirrored wittily the peculiarities of the people and scenes he portrayed. He wrote a Latin play 'Pompeius Magnus' (1610), and a Greek epithalium. His most notable work, however, is his 'Veer olde berömde Schertzgechichte.' Consult Classen, J., 'Ueber das Leben und die Schriften des Dichters J. Lauremberg' (1841).

LAURENCE, Richard, Anglican archbishop, younger brother of French Laurence: b. Bath, 1760; d. Dublin, 28 Dec. 1838. He was educated at Corpus Christi College, Oxford, and was ordained in the Church of England. He held the vicarage at Coleshill in 1787 and later was vicar of Great Cheverall and rector of Rollstone, Wiltshire. He became deputy regius professor of civil law under his brother at Oxford in 1796; and in 1804 delivered the Brampton lectures, «An attempt to illustrate those articles of the Church of England which the Calvinists improperly consider Calvinistical,» later published (1805; 3d ed., 1838). He was appointed rector of Mersham, Kent, in 1805, and of Stone, near Dartford, in 1811. A well-versed student of theology, canon law and Oriental languages, he was in 1814 appointed regius professor of Hebrew and a canon of Christ Church, Oxford. In 1822 he became archbishop of Cashel, Ireland. He was instrumental in having the study of Oriental languages given a more important place in English universities, was a zealous defender of the Church of England against the Calvinists and Unitarians, and succeeded in recovering from the Ethiopic manuscripts several supposedly lost apocryphal works, among them ‘The Ascension of the Prophet Isaiah’ (1819), and ‘The Book of Enoch the Prophet’ (1821). Author of numerous sermons and essays, and ‘Dissertations on the Logos of Saint John’ (1808); ‘On the Existence of the Soul After Death’ (1834); ‘Poetical Remains’ (1872; 25 copies, privately printed), etc.

LAURENCE, lâ'rĕns, **Saint,** Roman Christian martyr: d. Rome, 10 Aug. 258. He was of Spanish race, and when in the Valerian persecution Pope Sixtus II was carried to martyrdom, Laurence as deacon and treasurer of the Church refused to give up the keys of the treasury, and according to tradition was put to death by being laid over a fire on bars of iron. The Escurial was built by Philip II in fulfilment of a vow made on Saint Laurence's day, 10 August, to the honor of that saint, the ground plan being after the pattern of a gridiron.

LAURENCE, Samuel, English painter: b. Guilford, Surrey, 1812; d. London, 28 Feb. 1884. He was one of the most successful portrait painters of his day, and had as sitters many of his most eminent contemporaries, including Whewell, Browning, Carlyle, Dickens, Froude, F. D. Maurice, Thackeray and Tennyson. While on a visit to Longfellow in 1854 he painted a portrait of John Russell Lowell which has been engraved.

LAURENS, lâ'rĕns, **Henry,** American patriot and statesman: b. Charleston, S. C., 1724; d. there, 8 Dec. 1792. He was a mercantile clerk in London and Charleston and in the latter place established a successful business. An opponent of royal aggression, he was involved in numerous disputes with the Crown judges regarding their decisions in marine law and the admiralty courts. Having withdrawn from active business, in 1771 he went to England and was there one of the 38 Americans who in 1774 signed a petition to advise Parliament against passing the Boston port-bill. In 1775 he became a member of the first South Carolina provincial congress, in 1776 vice-president of the Council of Safety in that colony and from 1 Nov. 1777 to 10 Dec. 1778 was president of the Continental Congress in succession to Hancock. He sailed in 1779 as Minister to Holland for the negotiation of a treaty with that country, but his packet, the *Mercury*, was captured by the British, he was examined by the Privy Council and from 6 Oct. 1780 was imprisoned for about 15 months in the Tower on suspicion of high treason. Having been exchanged for Cornwallis, he was sent to Paris, where, with Adams, Franklin and Jay, he signed the preliminary treaty of peace with Great Britain 30 Nov. 1782. The collections of the South Carolina Historical Society contain many of his papers. Consult «Henry Laurens: Narrative of his Capture and Confinement in the Tower of London,» in ‘Collections’ of the South Carolina Historical Society (Vol. I, Charleston 1857); Moore, Frank, ‘Correspondence of Henry Laurens of South Carolina,’ in ‘Materials for History’ (New York 1861); Dawson, H. B. (ed.), ‘Laurens Petition and Letters’ (Morrisania, N. Y., 1866–67).

LAURENS, Jean Paul, zhŏṅ pōl lō-rŏṅ, French artist: b. Fourquevaux, department of Haute-Garonne, in 1838. He studied in the École des Beaux-Arts at Toulouse, and became a pupil of Cogniet and Bida in Paris. His work is distinguished for boldness and vigor, and the tragic elements of his subjects are heightened by the dramatic realism of the artist. In point of moderation, in treatment and of taste in coloring, his compositions have received some adverse criticism, but his powerful effects are not called in question. In 1886 he became a professor at the École des Beaux-Arts, in 1891 he was elected a member of the Institut and president of the Société des Artistes Français and in 1900 commander of the Legion of Honor. Among his pieces are ‘Death of Tiberius’ (1864); ‘A Voice in the Desert’ (1868); ‘Execution of the Duc d'Enghien’ (1872); ‘The Pool of Bethesda’ (1873); ‘The Interdict’ (1875); ‘The Austrian General Staff Around the Deathbed of General Marceau’ (1877); ‘Napoleon and Pius VII at Fontainebleau’ (1894), and the ‘Proclamation of the Republic in 1848’ (1902). He is also distinguished for his decorative work; notable frescoes from his brush adorn the Panthéon and the Paris Hôtel de Ville. Consult Van Dyke, C. J., ‘Modern French Painters.’

LAURENS, John, American soldier: b. South Carolina, 1753; d. there, 27 Aug. 1782. He was the son of Henry Laurens (q.v.). He was educated in England, and in 1777 became an aide to Washington, whose secretary he also frequently was. From the battle of Brandywine (11 Sept. 1777) he participated, it is said, in all actions in which Washington commanded. He was severely wounded at Germantown, commanded the light infantry when the united American and French troops under Lincoln and D'Estaing attempted the capture of Savannah, and aided in the defense of Charleston when besieged by Clinton. In the spring of 1781 he was sent to France to obtain money and supplies. Contrary to diplomatic precedent, he requested and obtained an audience with the king, and secured the necessary assistance. He captured one of two redoubts at Yorktown and received Cornwallis' sword. He was killed in a skirmish on the Combahee River, S. C. What Washington called his «intrepidity bordering on rashness» won for him the sobriquet of «the Bayard of the Revolution.» His correspondence, with a memoir by William Gilmore Simms, was privately printed in 1867.

LAURENS, formerly **LAURENSVILLE,** S. C., village and county-seat of Laurens County, 38 miles southwest of Spartansburg and 75 miles northwest of Columbia, on the Charleston and Western Carolina and the Columbia, Newberry and Laurens railroads. It is situated in an agricultural district, has cotton mills and a glass factory. Pop. 4,818.

LAURENT, Auguste, ō-güst lō-rŏñ, French chemist: b. La Folie, Haute-Saône, 14 Nov. 1807; d. Paris, 15 April 1853. In 1838 he became professor to the Academy of Sciences of Bordeaux, which post he held for eight years. In 1848 he was made assayer to the mint and chemical adviser of the Minister of War. His researches were very numerous, embracing all departments of the science, organic and inorganic, and opening up new fields and new views. He was one of the champions of the unitary system against the dualistic held by most of the chemists of the time. He was opposed also to the electro-chemical theory, which his investigations into the derivatives of naphthaline did so much to shake, and maintained the doctrine of types — forms of constitution of bodies which admitted of parts being substituted by other elemental or compound substances without the type of the original body being altered. His views on general chemical theory appeared in a posthumous work entitled ‹Méthode de chimie,› translated into English by Odling, and published by the Cavendish Society, 1855.

LAURENTIAN (lâ-rĕn'shĭ-ăn) **MOUNTAINS,** the crescent-shaped plateau-like height of land in British North America, extending for over 3,000 miles from Labrador to the Arctic Ocean, surrounding Hudson Bay, forming the watershed between Hudson Bay, the Saint Lawrence and the Great Lakes, and dividing the same bay from the sources of the Mackenzie River. The average elevation of this range is about 1,500 feet, while some of the peaks attain a height of 3,000 feet. The system is remarkable for its number of lakes and sheets of water. The rock formation belongs to the sedimentary deposits known as the Laurentian system.

LAURENTIAN SYSTEM. The term Laurentian has been applied by certain Canadian geologists to a great series of rocks, partly of sedimentary and partly of igneous origin, that is typically developed on the Laurentian Hills north of the Saint Lawrence River. Similar rocks occur elsewhere along the Height of Land, from Labrador to the western end of Lake Superior. The rocks are of very ancient date, but the exact significance of the term Laurentian as a time division or as a lithologic name is in dispute. The typical Laurentian includes a series of gneisses, mica, schists, quartzites and crystalline limestones with intrusive granites and green stones of the Archæan group, including also the Huronian. The total thickness may be 30,000 feet. By the United States Geological Survey, Laurentian is made an epoch of the Archæan period. During this epoch the Laurentian series of granite batholiths (q.v.) were intruded into the Keewatin (q.v.) series of greenstone schists (q.v.). The proper application of the term is in much dispute.

LAURIA, lou'rē-ą (**LURIA** or **LORIA**) **Ruggiero di,** Spanish-Italian admiral: b. Castle of Lauria, Lauria, Basilicata, 13th century; d. Valencia, 2 Jan. 1305. Of his early life little is known. His father was an adherent of King Manfred of Sicily, and his mother, Bella of Lauria, accompanied Constanza, the daughter of Manfred, to Spain where she was married to Peter, son of James, conqueror of Aragon. Lauria was reared in the court of Aragon, and received estates in Valencia after the subjection of that kingdom, but little is known of his life until 1282, when he accompanied Peter III on his expedition to Sicily. The Sicilian revolt, known as the «Sicilian Vespers,» had broken out against the ruler established by Charles of Anjou after the death of Manfred. Peter III claimed the kingdom by right of his wife as daughter and heiress of Manfred, and with the support of the Sicilian nobles. The expedition against the Anjou forces was successful and in 1283 Peter III was crowned king by the Sicilians. Lauria was thereupon made commander of the fleet, but while this first document concerning him refers to him in the highest terms it gives no clue to the nature of his services. As commander of the Aragon fleets, Lauria in the succeeding 20 years proved himself one of the greatest naval commanders in history, his career recording continuous victories. He fought in both the south Italian waters and off the coast of Catalonia, his first recorded victory being that over the naval force of Charles of Anjou off Malta in 1283. His fleets were maintained in a high degree of efficiency, and his methods included the use of the ram and of powerful crossbows instead of depending, as did the French, upon boarding and hand-to-hand fighting. He won a decisive victory over the Angevin fleet in the Bay of Naples, 1284, capturing Charles of Salerno, heir to the kingdom, who continued for years a prisoner in Sicily and Spain. His most brilliant exploit was the defeat of the French fleet off Catalonia in 1285, which still ranks as a supreme achievement in naval history. The French king, Phillipe le Hardi, invaded Catalonia with the purpose of aiding his cousin, Charles of Anjou, in his effort to regain Sicily. The invading army was supported by the French fleet off the coast, from which it drew reserves and supplies. Peter III summoned Lauria from the Sicilian coast, the commander reaching Barcelona 24 August. The nature of the French campaign necessitated the French fleet's being extended along the entire coast of the invaded territory, and while Lauria's fleet was greatly inferior in numbers his naval strategy was fully equal to the emergency. On 9 September at night he struck at the French centre near the Hormigas in full force and gained a complete victory. He then sailed for Rosas, induced the enemy fleet to come out by raising the French colors and visited upon it a defeat as crushing as the first blow upon the centre. The capture of the town followed, together with the stores massed there for the invading army. The retreat of King Phillipe soon followed, nearly his entire army being lost through hunger and the attacks of the mountaineers. The French naval power was so broken that it did not recover for many years, and Lauria returned to Sicily to resume command of King Peter's forces against those of Anjou.

The death of King Peter in 1286 materially changed the situation. He was succeeded on the throne of Aragon by his son James and in Sicily by Alphonso. Upon Alphonso's death James inherited the throne of Sicily and placed his younger brother Frederick there as viceroy. James made peace with the Angevin line, but the Sicilians offered the crown to Frederick who successfully withstood both his elder brother and the forces of Anjou. Lauria remained for a time with Frederick, but his dominating allegiance appears to have been to the house of Aragon and he returned to the support of James. Frederick thereupon confiscated Lauria's estates in Sicily and put his nephew to death, a retaliation which was afterward repaid in full in two crushing defeats of the Sicilians at sea. However, although badly beaten at sea, Frederick's land operations were more successful and the Peace of Calatabellota ended the war in 1302. Lauria retired to his vast estates in Valencia in 1303, where he died two years later. Lauria undoubtedly was merciless as a conqueror, a characteristic of his age, but his brilliancy as a commander was not rivaled for many generations. Consult Amari, M., 'Guerra del Vespro' (2 vols., 8th ed., 1876); Ramon de Muntaner, 'Chronicle,' edited by Karl Lanz (1844); Charles de la Roncière, 'Histoire de la marine française' (Vol. I, pp. 189–217, 1899).

LAURIA, Italy, city of Basilicata in the province of Potenza, near the borders of Calabria, seven miles south of the nearest railway station at Lagonegro, and 121 miles south of Naples. It is built upon the side of a steeply sloping hill, 1,821 feet above sea-level, and is in two parts, a walled portion above and the remainder on a plain below. It has a castle which was the birthplace of Ruggiero di Lauria (q.v.) in the 13th century. The French, under Masséna, destroyed the town in 1806. It is situated in section producing fruit, wine, potatoes and grain, and it manufactures rope, woolen goods and leather. Pop. 9,769.

LAURIC ACID, or **DODECOIC ACID,** a fatty acid occurring (as glyceryl ether) in the berries of the bay-tree (*Laurus nobilis*), in pichurim beans, in cocoanut oil and elsewhere. It may be prepared from the oils in which it occurs by saponification, followed by the fractional precipitation of the acids by means of barium acetate. Lauric acid has the formula $C_{12}H_{24}O_2$, and is insoluble in cold, and slightly soluble in hot, water, but very soluble in both alcohol and ether. From its solution in alcohol it crystallizes in the form of silky needles, melting at 110° F. With the metals it forms a series of salts called laurates, which, with the exception of barium laurate and the laurates of the alkali metals, are mostly insoluble in water. The laurates of the alkali metals and of barium are soluble in water, and much more soluble in salt water than the alkali metal salts of the other fatty acids. Hence "marine soap" is made from cocoanut oil. The glyceryl ether (also known as trilaurin, or laurostearin), has the formula $C_3H_5(C_{12}H_{23}O_2)_3$, melts at 113° F. and may be obtained from bay-berries by extraction with alcohol.

LAURIE, Arthur Pillans, Scottish chemist and educator: b. 6 Nov. 1861. He was a son of Simon Somerville Laurie (q.v.) and was educated at the universities of Edinburgh and Cambridge. He was a Fellow of King's College at Cambridge and in 1891 became Cantor lecturer. He was a member of the Home Office Committee on Pottery Manufacture in 1893, and lecturer in physics and chemistry at Saint Mary's Hospital Medical School in 1895, serving also as Gilchrist lecturer. He was examiner in chemistry to the Royal College of Physicians in 1898, and likewise examiner in oils and colors to the City and Guild's Institute. He was professor of chemistry to the Royal Academy of Arts in 1912, and is principal of the Heriot-Watt College, Edinburgh. In 1915 he was appointed to the Munitions Inventions Department of the Ministry of Munitions as a member of the panel of scientific experts. He edited 'The Teachers' Encyclopædia' (7 vols., 1911–12), and is author of 'Scientific Investigations in Physico-Chemistry'; 'The Food of Plants' (1893); 'Processes, Pigments and Vehicles — a Manual for Art Students' (1895); 'Greek and Roman Methods of Painting' (1910); 'The Pigments and Mediums of the Old Masters' (1914), etc.

LAURIE, John Wimburn, British Canadian soldier and legislator: b. London, 1 Oct. 1835; d. 20 May 1912. He was educated at Sandhurst and at the Staff College, and entered the 2d Queen's Royals as ensign in 1853. He volunteered for service in Crimea in 1854–56, where he saw service at Sebastopol and in both attacks on Redan. He was a staff-officer in the Indian Mutiny 1858–59, and was inspecting field-officer of militia in Canada in 1861–81. He joined the expedition to the Transvaal in 1881, and took an active part in the suppression of the half-breed rebellion in northwestern Canada in 1885. He was Red Cross commissioner in the Serbian-Bulgarian War in 1885, and was promoted lieutenant-general in 1887. In 1874–80 he was president of the Board of Agriculture in Nova Scotia, and in 1887–91 he served in the Canadian House of Commons as member from Shelburne. He was mayor of Paddington in 1907–08, and served in the English Parliament as member from Pembroke Boroughs in 1895–96. He received numerous medals in his military service and was likewise decorated in several foreign countries. He was a lecturer on agriculture, Scotch regiments in the army and on Imperial Federation.

LAURIE, low'rĭ, **Simon Somerville,** Scottish educator: b. Edinburgh, 13 Nov. 1829; d. there, 2 March 1909. He was educated at the University of Edinburgh; for five years was a teacher on the Continent; and returning to Scotland held important positions in connection with education. In 1876 he was appointed to the professorship of education in the University of Edinburgh. He published many works, among which are 'Philosophy of Ethics' (1866); 'Language and Linguistic Method in the School' (1892); and 'Historical Survey of Pre-Christian Education' (1895); 'Synthetica' (1906).

LAURIER, lo'ri-a, Sir **Wilfrid,** Canadian statesman: b. Saint Lin, Quebec, 20 Nov. 1841; d. Ottawa, 17 Feb. 1919, the only son of Carolus Laurier, whose ancestors came from France in the latter half of the 17th century, and of Marcille Martineau. He received his early education at L'Assomption College, and studied law at McGill University (Montreal); in 1865 and 1866 was a vice-president of the Institut Canadien (Montreal), which formed the nucleus of a movement toward intellectual liberalism on the part of the younger French and was strongly opposed by the clergy; and in 1866 opened a law office at Arthabaskaville. In 1868 he married Miss Zoë Lafontaine of Montreal. In 1871 he was elected to the Quebec legislature, and in 1874 he was chosen as Liberal member of the Dominion House of Commons for Drummond and Arthabaska. He was soon recognized as one of the most eloquent speakers in the Canadian Parliament. At the outset he was regarded as the leader of the Liberals in Quebec province; a speech of his in defense of Catholic liberalism, delivered in Quebec June 1877, was received with enthusiasm throughout the country; a few months later he was selected for the portfolio of inland revenue in the Mackenzie administration. On 7 June 1887 he succeeded Blake as chief of the Liberal opposition, though he himself advised the choice of an English-speaking Protestant; and in 1896, on the return of the Liberals to power, he became Prime Minister of Canada. That position he filled with remarkable distinction until the return of the Conservatives in 1911. Measures associated with his premiership were the framing of a British preferential tariff and a consequent tariff war with Germany; a compromise settlement of the Manitoba schools question; the organization of two new provinces, Saskatchewan and Alberta; extensive railway developments; and the framing of the Taft-Fielding reciprocity agreement, on which his party was defeated at the polls.

Of all the representatives of the colonies in England on the occasion of Queen Victoria's Diamond Jubilee, he was the most remarked for the refinement of his manners and the elegance of his diction, and was recognized in Paris as in London as one of the most eloquent speakers of his time either in French or English. While a great admirer of England's political institutions, and a Liberal of the English rather than of the Continental school. he was an ardent Canadian and a thorough believer in Canada's destiny. He opposed the imperialistic policy of Chamberlain and contributed more than any other man to prevent him from drawing the colonies into the «vortex of warlike imperialism,» to use his expression. He had to pass through all kinds of political and religious difficulties, and gave evidence of qualities and talents which would have made him distinguished as a speaker and a statesman in any country of the world. Not the least of his services to Canada has been the splendid contribution he made, throughout a long life, to the furtherance of good relations and mutual helpfulness between the two great races of which the population is mainly composed.

As leader of the opposition he approved of Canada's participation in the European War, and he addressed a number of meetings in the province of Quebec with the object of stimulating recruiting among French-Canadians for service in the forces being sent overseas. Consult his ‘Speeches,’ edited by Barthe (1890); Willison, ‘Sir Wilfrid Laurier and the Liberal Party’ (1903); Daniel, ‘Laurier and His Time’; and Skelton, ‘The Day of Sir Wilfrid Laurier’ (1916).

LAURION, or **LAURIUM,** also **ERGASTERIA,** Greece, mountain range and mining town in southern Attica. The silver mines through which the town and district became famous apparently were known from very early times; but their historic importance dates from the time of the Athenians, for whom they produced a large revenue and whom they materially aided in maintaining commercial ascendency. Themistocles seized the opportunity after the battle of Marathon to secure the devotion of the mining revenues for the building of a navy and the adoption of his plan resulted in the Athenian naval power and the victory at the battle of Salamis. The mines were let out to individuals, the state receiving a fixed rental in addition to a percentage of the profits, and they were worked by slaves. Toward the end of the 5th century the importance of the mines declined and while they were worked up to the opening of the Christian era the output steadily diminished until it came chiefly from the working over of tailings. The ancient workings are still in a good state of preservation. French and Greek companies took over the rights to the mines in the middle of the 19th century and they are now worked for lead, manganese and cadmium. The mining district is connected by rail with the port of the same name. Pop. about 10,000.

LAURISTON, lō'rē'stôn, **Jacques Alexandre Bernard Law,** Marquis de, French general and diplomat: b. Pondicherry, India, 1 Feb. 1768; d. Paris, 12 June 1828. He received a military education at Paris and Brienne, and as a cadet was on friendly terms with Napoleon. He was commissioned in 1786, served in the earlier Revolutionary campaigns in the Netherlands and on the Rhine, and in 1795 was promoted brigadier-general of artillery. In 1800 he was appointed aide-de-camp to Napoleon. He was director of Le Fère Artillery School, special envoy to Denmark, and in 1802 was sent to England to present the ratification of the Peace of Amiens. He became general of division in 1805, fought in the war against Austria, and in 1806 occupied Venice and Ragusa. He was appointed governor-general of Venice in 1807, was present at the Erfurt negotiations of 1808, and later participated in the Spanish and Italian campaigns. He commanded the artillery at the battle of Wagram in 1809 and by his furious onslaught at the Austrian centre won a decisive victory. He served as Ambassador to Russia in 1811, and in 1812 he rendered important service in covering the retreat from Moscow. He was in command of different army corps at Lützen, Bautzen and in the autumn campaign, and was taken prisoner in the retreat from Leipzig in 1813. He was released upon the fall of the empire and joined Louis XVIII. He was given a seat in the House of Peers, a command in the royal guard, was created a marquis in 1817 and marshal of France in 1823. In the invasion of Spain in 1823 he commanded the siege and capture of Pamplona.

LAURIUM, lâ'rĭ-ŭm, **Mich.,** village in Houghton County, on the Copper Range and Mineral Range railroads. It adjoins Calumet, and is seven miles from Lake Superior and 12 miles north by east from Houghton. It is situated in the Keweenaw Peninsula, in the northern part of the State, in one of the richest copper regions of the United States. There is considerable local trade. Copper mining is the chief occupation. Pop. 9,770.

LAURVIK, lour'vĕk, or **LARVIK,** or **LAURVIG,** Norway, seaport and watering resort, on the Larvikfjord, at the mouth of the Laagen River, four miles south of Fredriksvaern and 98 miles southwest of Christiania, on the Skein Railway. The port has a depth of from 18 to 24 feet. The city has a considerable industrial activity and exports timber, ice, woodpulp and granite. There are sulphur and mineral springs, and the mud baths are famous. Pop. 10,105.

LAUSANNE, lō'ząn, Switzerland, capital of the canton of Vaud; situated on the Jorat Mountain Range, on the river Flon, one mile north of Lake Geneva at a junction of railways from Geneva, Brieg and the Simplon, Freiberg and Bern, and from Vallorbe for Paris. There is a funicular railway between the town proper and Ouchy, its port on Lake Geneva. The older portion of the town was built upon five hillocks, to which was due much of its picturesque beauty. The improvement project of filling the valleys and hollows between the hills was begun in 1836 and completed in the early part of the 20th century with considerable impairment of the natural beauty of the city, although some fine squares have been built on the filled-in portions. The Flon Valley is spanned by the Grand Pont, a two-story viaduct built in 1839–44, and the bridge of Chanderon was constructed in 1905. The railroads have given the modern Lausanne a considerable commercial importance as it is now on the international route from Paris to Milan, and the town is growing, extending its limits chiefly on the south and west.

The cathedral of Notre Dame was consecrated by Pope Gregory X in 1275 and is considered the finest structure of its sort in Switzerland. It was sacked after the Bernese conquest, when the cathedral became Protestant. It is Gothic in type and was restored under the direction of Viollet-le-Duc in 1875–1906. Sharing with the cathedral the highest ground in Lausanne is the castle, dating from early in the 15th century, built by the bishops, but now used as an administration building by the canton of Vaud. Near these on the Place de la Riponne is the Palais de Rumine, opened in 1906, wherein are lodged the libraries of the canton and the university, the collection of the Musée Arlaud and the canton's collections of natural history, archæology and industrial art. The university was founded as an academy in 1537 and was raised to its present rank in 1890. Lausanne has besides a Protestant theological school in connection with the cathedral, a number of boarding schools and many scientific and literary societies. It is a recognized literary centre, is much frequented by foreigners and has a large resident foreign population. It was the birthplace of Benjamin Constant and the historian Gibbons lived there many years. The population is in the main French-speaking and Protestant.

The ancient town was on the shore of the lake southwest of the present site and was destroyed by the Alamanni in the 4th century. The inhabitants re-established their homes in the hills and in 590 the new town was chosen by Bishop Marius as his see city. There was a Burgundian settlement across the Flon and another settlement around the church of Saint Laurent, both of which eventually became part of Lausanne. The bishops became princes of the empire in 1125, but from 1368 their powers over the municipality were gradually decreased. After the Bernese occupation, 1536–1798, Lausanne became capital of the canton Léman and upon the creation of the canton of Vaud in 1803 it was made its capital. Pop. 63,923.

LAUSSEDAT, Aimé, ā'mā lōs'dą, French geodesist and astronomer: b. Moulins, 19 Feb. 1819; d. Paris, 18 March 1907. He was educated at the École Polytechnique, where, after some years in the engineers, engaged principally in the fortifications of Paris and the Spanish frontier, he returned in 1856 to take the chair of geodesy and astronomy. In 1871 he became professor of applied geometry at the Conservatoire des Arts et Métiers and in 1881 he was appointed director there. The unification of French time to that of Paris became a law through his efforts 14 March 1891. He invented and improved many instruments in use in geodetic photography and astronomical observations and was keenly interested in the development of aerial transportation, serving as president of a commission appointed in its interests. Author of 'Leçons sur l'art de lever les plans' (1860); 'Recherches sur les instruments, les methodes et le dessin topographiques' (2 vols., 1898–1903), etc.

LAUT, Agnes C., Canadian author: b. Stanley, Ontario, 11 Feb. 1871. In childhood she was taken to Winnipeg. She attended Manitoba University, afterward spending her summers in the Rocky and Selkirk mountains. In 1895–97 she was an editorial writer for the Manitoba *Free Press,* Winnipeg. She has written 'Lords of the North' (1900); 'Heralds of Empire' (1902); 'Pathfinders of the West' (1904); 'Vikings of the Pacific' (1906); 'The Conquest of the Great North-West' (1908); 'Freebooters of the Wilderness' (1910); 'Pioneers of the Pacific Coast' (1915).

LAUTERBRUNNEN, lou'tĕr-brŭn'ĕn, Switzerland, village in the canton of Bern, in a valley of the same name traversed by the White Lütschine River, seven miles southeast of Interlaken and 33 miles southeast of Bern on the Bernese Oberland Railroad. The valley has some of the most magnificent scenery in Switzerland and the town is built at the foot of the Jungfrau, while the Schwarz Möuch and Breithorne combine so to shadow it that the sun does not touch it before seven in the summer nor until noon in the winter. The view of the Jungfrau is superb and the valley, which takes its name from its numerous springs, has some splendid cascades, among which is the Staubbach, 980 feet in height. Others are the Trümmelbach and Schmadribach. The altitude of the town is 2,580–2,645 feet. Tourists come here in great numbers. Pop. 3,318.

LAUTREC, lō'trĕk', **Odet de Foix,** Vicomte de, French general: b. 1485; d: Naples, 15 Aug. 1528. He was brother to Françoise de Chateaubriant, mistress of Francis I, through whose influence he gained high offices. He served in the campaign of Marignano in 1515 and in 1516 became governor of Milan where he enacted measures of the utmost severity. He was successful in defending the duchy in 1521, but he met disastrous defeat at the battle of the Biocca in 1522. He was created marshal of France in 1527, and in command of the army of Italy he succeeded in again occupying Milan; he then undertook the siege of Naples, but died of the plague without accomplishing his mission. Authorities differ concerning him and his rank as a general. He is by some considered brilliant and able although unfortunate, while others maintain that such assertions are without grounds.

LAUZON, Jean de, zhŏṅ dė lō-zŏṅ, French colonial administrator: b. 1582; d. 1666. He was a member of the Hundred Associates, who organized to promote the settlement of New France. He seems to have directed most of his energies toward acquiring landed property in Canada for himself and his family and gained for his son the sole right of fishing on 60 leagues of the Saint Lawrence, with a title to the adjacent lands. His own title to the island of Montreal he sold to the Jesuits in 1640. He was for five years governor of New France (1651–56), but his policy was feeble and short-sighted. He returned to France before his second term was over.

LAUZON, or **SAINT JOSEPH,** Canada, village in Lévis County, in the province of Quebec, on the south bank of the Saint Lawrence River, five miles east of the city of Quebec, on the Intercolonial and the Quebec Central railroads. It has a ferry to Quebec and is connected with Lévis, two miles distant, by an electric railway. Its industries include shipbuilding and it sells aërated waters. Pop. 3,978.

LAVA AND LAVA FLOWS. The fluid rock poured out by a volcanic vent is known as lava. If this is very viscous it may accumulate near the vent and form a cone. If it is very fluid it may flow out into a thin sheet spreading far over the surrounding country. The rate of flow is rarely over a mile an hour. As the lava advances it destroys all life in its path, burning and scorching the vegetation. As the mass begins to cool its surface may solidify and break open many times, becoming exceedingly rugged, or scoriaceous as it is called. Very rough cindery surfaces are called Aa (q.v.) and smooth surfaces Pahoehoe, from the Hawaiian. Lava surfaces are often highly vesicular or amygdaloidal (q.v.). In some regions lava flows have accumulated one above another to great depths, as in the Columbia Plateau, where as many as 40 distinctive flows can be seen along the side of a canyon wall, separated by thin layers of soil. See Volcanoes, and section on *Volcanism* in article on Geology.

LAVAGE. The washing of any cavity of the body, by means of a flow of water by gravity through a rubber tube, and the withdrawing of the water and whatever comes with it through the same tube. Thus the bowels and the bladder may be irrigated, as it is then called. Specifically lavage is a term generally used of the removal of the contents of the stomach for various purposes. A rubber tube about five feet long is used. The patient, in a sitting position, with head thrown back, inserts the tube into his mouth, and it is then forced gently downward for about 22 inches, with the help of swallowing movements. To the other end of the tube a vessel, such as a funnel is attached and into this is placed a pint to a quart of warm sterilized water or weak alkiline solution. The funnel is then raised to a height above the patient's head sufficient to allow the water to flow gently into the stomach. When it has disappeared from the funnel, the funnel is lowered and the water, with the contents of the stomach, flows out into it. This process is used either in the analysis of test meals, to discover conditions of acidity, secretion of mucus, the rate of digestion, etc., or for the purpose of treating such disorders as catarrh of the stomach. The patient can easily learn to carry out the whole process himself. With a still greater amount of skill a special form of tube can be passed through the stomach, the pylorus and into the duodenum, and thus that part also can be lavaged. For the lavage of children's stomachs a smaller tube and quantity of water is used.

Smith Ely Jelliffe.

LAVAL, lạ'vạl', France, capital city of the department of Mayenne, on the Mayenne River, 46 miles east of Rennes and 188 miles by rail southwest of Paris. The town is built upon both sides of the river, the ancient portion occupying the hills to one side while the modern town stretches over the plains on the opposite banks. The river is 124 feet wide at this point and is spanned by a railway viaduct; the stone bridge, Pont Neuf, and the Pont Vieux with its three pointed arches, which dates from the 16th century. The town is considered one of the most beautiful in France. In the ancient portion with its narrow, twisting streets are the cathedral, built in the 16th century; the castle of the counts with a donjon built in the 12th century; the 14th–15th century church of Notre Dame; the 12th century church of Notre Dame d'Avéntirès and the 15th century church of Saint Vénérand. It has many houses of the 15th and 16th centuries. There are also an art museum, a museum of natural history and archæology, a library and a linen hall. The modern town has fine promenades and modern educational institutions. The town existed in the 9th century. It was taken by Talbot in 1428, and suffered considerably in the Vendean war, the Vendeans under Rochejacquelin here defeating the Republicans 24–25 Oct. 1793. Its chief and oldest industry is the manufacture of cotton and linen cloth, introduced from Flanders in the 14th century. There are other manufacturing interests, including foundries, flour-mills, shoe factories, tanning and dyeing. There is a trade in marble and in grain. The bishopric was created in 1855. Pop. 25,540.

LAVAL–MONTMORENCY, François Xavier de, fraṅ-swä ksăv-ē-ā dė lä-väl-môṅ-mō-rŏṅ-sē, French Roman Catholic prelate: b. Laval, France, 30 April 1623; d. Quebec, 6 May 1708. He became a priest in 1645 and in 1651 was appointed missionary bishop of Cochin-China, a post which he declined to become archdeacon of Evreux. In 1659 he came to Canada as apostolic vicar, with the dignity of bishop of Petra *in partibus*. There he established (1663) the Quebec Seminary. In 1674–83 he was titular bishop of Quebec. He was an active and influential figure in governmental affairs. He opposed the sale of intoxicating liquors to Indians. He is regarded with great veneration by the French Canadians. Laval University is named in his honor.

LAVAL UNIVERSITY, Montreal, Canada, was founded at Quebec, in 1852, by the seminary of that city, which gave it the name of its own founder, Mgr. François de Montmorency-Laval, first bishop of Quebec. The directors of this institution obtained then from Her Majesty Queen Victoria a charter which in confirming the rights and privileges they had enjoyed up to that time also conferred upon them university rights and privileges, for the instruction of youth in secondary and professional studies.

In 1876, following a request from Mgr. Bourget, bishop of Montreal, to secure a Catholic university in his episcopal city, the Sacred Congregation of the Propaganda enjoined Laval University to establish a section at Montreal, to give therein the same instruction as at Quebec. This curriculum was inaugurated in 1878, in the faculties of theology and law, in 1879 in the faculty of medicine and in 1887 in the faculty of arts. By virtue of the apostolic constitution Jamdudum, of 2 Feb. 1889, the section is to-day practically independent of the establishment at Quebec. It receives its degrees from that University Council, but enjoys its own government and a complete local administration. It comprises four faculties; those of theology, law, medicine and of arts (sciences and letters), seven aggregated schools, the Polytechnic, the School of Comparative Medicine and Veterinary Science of Montreal, that of Dental Surgery, that of Pharmacy, Notre Dame Ladies' College, the Agricultural College at Oka and the School of Higher Commercial Studies. The French language is used in all sections except that of theology, where Latin prevails. The professors of the faculty of theology are appointed by the Grand Seminary of Montreal, directed by the priests of Saint Sulpice. The ordinary course is three years and three months. Some pupils prolong their stay six months to prepare themselves for doctorship. A greater number, after completing their course at Montreal, go to take their degrees in Rome, where the Seminary of Saint Sulpice of Montreal has opened a college for Canadian students.

The faculties of law and medicines are installed in an edifice on Saint Denis street, where they have large classrooms, sectional libraries, playrooms, a gymnasium, etc. The faculty of medicine has a lecture-room, a dissecting-room and four laboratories, for chemistry, histology, bacteriology and medical electricity. The present faculty of medicine continues the School of Medicine and Surgery of Montreal, founded in 1845 and affiliated to the Victoria University of Coburg (Ontario), from which it received its degrees until the year 1890. At this period the school had its charter modified by the Quebec government and allied itself to the Montreal section of the faculty of medicine of Laval University, with which to-day it forms one body. It receives its degrees from Laval University, but has maintained its charter and autonomy.

As the scientific and literary course which is usually followed by this faculty in the English universities is given, in this province, to Catholic youths by the colleges and seminary schools affiliated to Laval University, where the pupils obtain the degrees of bachelor of letters, of sciences or arts, a complete instruction of this kind is not imposed on the university. Seven courses, relevant to this faculty, are actually given there, that of French literature, founded in 1898, by the late Abbé Colin, superior of the Seminary of Saint Sulpice of Montreal. Up to that time this course had been given by a Fellow of the Paris University. The second course has for its object ecclesiastical public law, and comprises 20 lessons. The five other courses are those of history of fine arts, economics, Gregorian plain-chant, pedagogy and French-Canadian history. The other professors, ecclesiastic or lay, of the faculty of arts give a regular course in the colleges affiliated to the university, or are occasionally called to give public conferences at the university. To this faculty have been annexed a college for the higher education of young girls, which is under the immediate supervision of the congregation of Notre Dame, and a college of modern literary teaching for members of religious communities and laymen also. This year the faculty gave a summer school for masters of secondary and primary instruction.

The Polytechnic School of Montreal, founded in 1874 and aggregated to Laval University in 1887, is largely supported by the government of the province of Quebec. It corresponds, by the nature of its curriculum, to the faculty of applied science in other universities. It prepares for the different branches of civil and industrial engineering, such as public works, railways, engines, mines, bridges and steel construction, etc. A branch of decorative and industrial arts has been connected with it recently. Previously the school also was provided with a prosperous School of Architecture.

The School of Comparative Medicine and Veterinary Science of Montreal exists since 1886. Aggregated to the university, it is under the control and submissive to the inspection of the Minister of Agriculture of the government of Quebec, from which it receives a grant. Its system requires a four years' course and the final degree is that of doctor of veterinary medicine. The school, which occupies very fine premises at 387 De Montiguy street East, has a very interesting pathological museum at the university. The number of pupils, nearly all from this province, is not great, but it tends to increase as the farmers are beginning to recognize the value of the services which can be rendered them by veterinary doctors, who are well up in their profession. The School of Dental Surgery of Montreal, located at 380 Saint Hubert street, spaciously and richly, is the continuation of the French section of the College of Dentistry of the Province of Quebec founded in 1894. It was affiliated to Laval University in February 1904, and obtained legal existence by an act of the legislature of Quebec, in the month of May of the same year. This school, intended for the French Canadian youth of this country and the need for which arose from the rapid progress dental surgery has made within the past few years, is now launched, left to its own resources and depending solely on the devotedness of its professors. The course covers a period of four years and the final degree is that of doctor of dental surgery. The infirmary is open every day from 1 October to 1 April, from 9 A.M. until noon, and the poor receive, under the direction of competent professors, gratuitous attention or at a slight outlay to cover the cost of material. The School of Pharmacy, affiliated in May 1906, with 124 students actually; the Agricultural College at Oka, affiliated in March 1908, and which numbers nearly 200 pupils, mostly graduates of the secondary colleges; finally, the School for Higher Commercial Education, founded by the government itself and affiliated in April 1915, form three of the most interesting departments of this prosperous institution. The latter constitutes one of the most impressive buildings of the city, facing the old and famous Viger square and the actual Viger station. In the very present, an understanding is working to the effect of soon connecting with the university a school of music, both vocal and instrumental.

An ecclesiastical vice-rector, chosen by the bishops of the province of Montreal, is appointed by the University Council of Quebec. He represents, for discipline and general administration, the university, the corporation of administrators and the bureau of governors; an executive committee of five members, delegated by the bureau, assists him in the management of current affairs and in the execution of the decisions of the corporation and bureau.

The archbishop of Montreal, by rank of vice-chancellor, controls the nomination and dismissal of the professors, and exercises a strict surveillance over doctrine and discipline. He is by right the president of the corporation of administrators, which owns the university and manages its finances. The suffragan bishops of the ecclesiastical province of Montreal, the delegates of all the affiliated colleges and seminaries of the same province, the delegates of faculties and former graduates also sit in this corporation, which generally operates through a bureau of governors, composed of eminent personages in finance and the liberal professions.

EMILE CHARTIER,
Registrar of the University.

LAVAL UNIVERSITY, Quebec, Canada. The first establishment of higher education in Lower Canada was founded in 1852. The directors of the Seminary of Quebec, the pioneer institute in the educational field, secured from her majesty, Queen Victoria, a charter, which conferred on the seminary the privileges of a university. A petition signed by the archbishop and bishops of the ecclesiastical province of Upper and Lower Canada was presented at Rome, requesting that the Seminary of Quebec be accorded the customary rights of a Catholic university, and in particular that of conferring diplomas in theology and canon law. Pius IX did not at once grant what was asked. At that time Great Britain refused to recognize the ecclesiastical titles given by the Holy See; she also denied legal existence to the Catholic University of Dublin, and it was feared in Rome that the foundation of a Catholic university in Quebec would prove an impossibility. For this reason Rome wished to be assured of the grant of a royal charter before it extended canonical privileges. As soon as the official document was received from London, which was toward the end of December 1852, an authentic copy was forwarded to Rome and on 6 March 1853 the Holy Father sent a brief which granted to the archbishop of Quebec the right to confer theological degrees upon those who completed their ecclesiastical studies at the Quebec University.

In the Royal Charter, the Roman Catholic archbishop of Quebec, by virtue of his office, is named the visitor of the university, which shows the broad-mindedness of the English government which permitted the French-Canadian Catholics to organize their university teaching without any control save that of an archbishop of their own nationality and faith. The state renounced all interference in questions of program or inspection. The visitor received the most extensive powers, he was given the right to veto on all regulations and nominations, and on presentation of the council, he could appoint the professors of the faculty of theology. As to the office of rector, the highest in the university, it devolves, by right, by the terms of the charter upon the superior of the Seminary of Quebec. This office is, therefore, essentially temporary, since the superior of the seminary, elected for three years and re-eligible after the first triennial, cannot occupy the post entrusted to him longer than six consecutive years, unless a special authorization be accorded by ecclesiastical authority.

The charter also provides for the establishment of a council which conjointly with the rector administers the affairs of the university. This council is composed of all the directors of the seminary and of the three oldest titulary professors of each faculty. It has the power to make the statutes and regulations which it may judge suitable, with one condition, that these statutes and regulations contain nothing contrary to the laws of the United Kingdom or of Canada.

This council held its first session on 21 Feb. 1853, when it resolved that Laval University should include four faculties: those of theology, law, medicine and arts. Each faculty is provided with a special council which discusses and submits to the university council all questions which may directly interest one or the other of these faculties.

The faculty of theology was not immediately created at Quebec. The number of aspirants to the priesthood was limited and the needs of the parochial ministry so urgent and so multitudinous that the seminarians could not be allowed the time to devote themselves freely to the study of the higher ecclesiastical sciences. It was only in the year 1866 that the basis of a faculty of theology was laid. The faculty of medicine, on the contrary, was organized and put in motion in the year 1853. A School of Medicine already existed in Quebec. The directors of the university found therein a certain number of professors who were prepared to give medical instruction. The School of Medicine was willing to efface itself and make way for the budding faculty of Laval, and six of its professors resigned and accepted professorships at the university. The course in medicine was fixed at four years. As there were two large hospitals in Quebec, those of the Hotel-Dieu and the Navy, the students of the faculty were enabled to follow numerous and various clinics.

It was not such an easy task to organize a faculty of law, and in the year 1854 the first steps toward this end were taken. However, of all the branches of the university, teaching of law was the one for which the greatest need existed, as there was no school of law in Quebec. There were many distinguished lawyers who could have filled professorships but they lacked the enthusiasm to devote themselves to teaching and were not willing to sacrifice, however little, without sufficient compensation, a numerous clientele. There was great difficulty in realizing the plan first conceived. After various proceedings, two professors were found, one being a judge of the Superior Court, who was named dean. In 1855 the university council was able to add four other representatives to the faculty of law. Unfortunately the greatest number of these professors were prevented, by reason of their external occupations, from preparing and giving their courses so much so that during several years the teaching of the faculty of laws was limited to the courses of civil and Roman law. In 1857, it was necessary to call a professor from France to give lectures on Roman law.

The faculty of arts was at first the least favored of all the faculties. The students who had received at the colleges and seminaries the basis of a literary or scientific education were not inclined to further pursue these studies. Being obliged to earn a livelihood by entering one or the other of the liberal professions they commenced their studies in theology, law or medicine immediately upon terminating their classical course. They had neither time nor money to devote to the study of the higher branches of letters and sciences. For this reason Laval University did not deem it opportune to establish, in the first years of its existence, professorships of advanced instruction in the faculty of arts. In 1855 a faculty of arts was outlined.

Laval University had by virtue of its charter the power to confer diplomas of bachelor, licentiate or master, and of doctor in the faculties of law, medicine and arts. It could not confer degrees in theology. The papal brief accorded by Pius IX granted this privilege to the archbishop of Quebec. The university did not receive all the rights of a canonical university until the year 1876.

In 1870 the faculty of medicine of Laval had the favor and honor of being affiliated to the Royal College of Surgeons of London. This granted the university and the students of the faculty of medicine the following privileges: (1) The enrolment examination of Laval University is recognized as equivalent to the preliminary examination of the Royal College of Surgeons of London; (2) the certificates of assiduity gained by enrolled students of the medical course are recognized by the Royal College; (3) doctors in medicine of Laval University are admitted to the examination for diploma as member of the Royal College of Surgeons of London.

In 1865 the rector asked and obtained from Rome an indult which gave the archbishop of Quebec the power to confer degrees in theology upon all students of the grand seminaries of the Canadian province. In 1866 Laval University organized its faculty of theology.

The library of the Quebec Seminary included at the time of the foundation of the university over 15,000 volumes; 1,000 volumes for the faculty of law, and 2,000 volumes for the faculty of medicine, were then added. In 1876 this library contained about 55,000 volumes. At the present time it contains over 140,000. The seminary cabinet of physics is one of the most complete in America.

In 1897–98 a bacteriological laboratory was installed and in the following year a laboratory in experimental chemistry for analytical work was placed at the disposal of the students. The university has a number of splendid museums as follows: (1) Invertebrate Museum, comprising of several distinct collections. The entomological collection numbers over 14,000 specimens of insects from all parts of the world. The conchological collection contains nearly 1,000 species of Canadian and foreign mollusks. (2) Museum of Ethnology, in three divisions: (a) the Indian collection; (b) the Chinese and Japanese collection; (c) the general collection. (3) Religious Museum, containing religious souvenirs, etc., and particularly the lead tomb with remains of the wooden coffin in which reposed for nearly two centuries the remains of Francis de Laval, first Catholic bishop of Canada and founder of Quebec Seminary. (4) Museum of Paintings, containing many old and valuable paintings by the old masters. (5) Mineralogical and Geological Museum, containing over 5,000 specimens. (6) Botanical Museum. (7) Zoological Museum. (8) Numismatic Museum containing over 3,000 coins and medals.

The faculty of theology numbers 650 and there are 380 students in the other faculties. The faculty of theology has 35 professors and 25 auxiliary professors, and the other faculties have 21 professors and 18 auxiliary professors.

LAVATER, lä'vä-tĕr, **Johann Kaspar**, Swiss physiognomist: b. Zürich, 15 Nov. 1741; d. 2 Jan. 1801. As a youth he was not distinguished for studious methods, but early manifested a fervent piety and remarkable powers of persuasion in public discourse. He developed a distinct poetic gift, and was first known through his verses in 1767. Two years later he took orders, became pastor of a Zürich church in 1764, and served in that calling with different churches in his native city until his death. He also enjoyed a contemporary popularity through his mystical writings, now almost forgotten. He is best remembered as the originator of a system of physiognomy, which, although of little practical account to-day, is often referred to by students and writers. The book in which he set forth his system is entitled 'Physiognomische Fragmente zur Beförderung der Menschenkenntniss und Menschenliebe' ('Physiognomical Fragments for the Promotion of a Knowledge of Man and of Love of Man,' 1775–78). It was ornately published, with a profusion of striking illustrations, including portraits of distinguished persons, features to which its fame is considered to have been largely due. Yet Lavater's observations display a penetration and insight into human nature and its varying traits which entitle him to some consideration as scientist and philosopher, and there is a residue of his teachings which the inquiring world still appreciates. He enjoyed an intimate acquaintance with Goethe, who contributed to the 'Fragments' a chapter on the skulls of animals, and strikingly portrayed Lavater in 'Wahrheit und Dichtung.' Goethe afterward became estranged from him, accusing him, not without some grounds, of hypocrisy and superstition, but probably in fact repelled by Lavater's intellectual bigotry. Still Lavater was a man of large and open heart, personally and socially as hospitable as he was mentally intolerant, and with characteristics of true saintliness. During the French occupation of Switzerland he gave proof of his patriotism, and his death resulted from a wound inflicted by a French soldier at the capture of Zürich in 1799. There are several English translations of the 'Fragments.' Consult Lives by Gessner (1802), Heisch (English 1842), Muncker (1883), and monographs by Steck (1884) and Von der Hellen (1888). See PHYSIOGNOMY.

LAVEDAN, Henri, ŏṅ-rē lä-vė-däṅ, French journalist, critic, novelist and playwright: b. Orleans, 1859. He began life as a journalist and novelist, but his best work has been as a dramatist. He was elected to the Academy in 1898. He contributed under the pseudonym of «Manchecourt» a series of brilliant articles to *Vie Parisienne*, *Gil Blas*, etc., and in fiction has published 'Mam'zelle Virtue' (1885); 'Queen Janvier' (1886); 'Lydie' (1887); 'Inconsolable' (1888); 'High Life' (1891); 'A New Game' (1892); 'Teur beau physique' (1894); 'Leurs soeurs' (1895); 'C'est servi' (1904); 'Baignoire 9' (1905). Among his plays the most notable are 'A Family' (1890), awarded a prize of 4,000 francs by the French Academy, and 'Prince d'Aurec' (acted in 1892); 'Le vieux marcheur' (1895); 'Les deux noblesses' (1897); 'Le marquis de Priola' (1902); 'Viveurs' and 'Varennes,' with G. Lenôtre (1904); 'Le duel' (1905), produced in New York in 1906; 'Le bon temps' (1906); 'Sire' (1910), produced in New York in 1911; 'Servir' (1913).

LAVELEYE, Emile Louis Victor de, ā-mēl loo-ē vĕk-tōr dė läv-lā, Belgian political economist: b. Bruges, 5 April 1822; d. Doyon, near Liège, 3 Jan. 1892. He was educated at the College Stanislas, Paris, and at the University of Ghent, where he studied law, and in 1864 became professor of political economy in the University of Liège. Among his numerous writings are 'History of the Provençal Language and Literature' (1846); 'The Question of Gold' (1860); 'Property and its Primitive Form' (1874), his best-known work; 'The Religious Conflict in Europe' (1875); 'Contemporary Socialism' (1881); 'Elements of Political Economy' (1882); 'Money and International Bimetallism' (1891); 'Government in Democracies' (1891).

LAVELLE, lą-vĕl, **Michael J.,** American Roman Catholic prelate: b. New York city, 3 May 1856. He was graduated at Manhattan College in 1873 and at Saint Joseph's Seminary, Troy, in 1874. He was ordained in the priesthood 7 June 1879, and was appointed assistant rector at Saint Patrick's Cathedral in that year. Since 1886 he has been rector there. He was appointed vicar-general of New York in 1902 and domestic prelate to Pope Pius X in 1903.

LAVENDER, a genus (*Lavandula*) of perennial herbs, sub-shrubs and shrubs of the order *Labiatæ*, consisting of about 20 species, native to the Mediterranean region and southwestern Asia. The best known are true lavender (*L. vera*) and spike lavender (*L. spica*), which like other members of the genus have narrow leaves crowded near the ground, and blue or violet two-lipped flowers in whorls which form more or less interrupted spikes. All the lavenders contain similar volatile oils (oil of lavender, oil of spike, etc.), for which the plants are cultivated and which are obtained from the flowers by distillation with water. The principal use of these oils is in perfumery, but they have been used in medicine as stimulants, tonics and stomachics. The dried flowers are placed with clothing laid away in bureaus and chests, partly because their aroma repels moths, but chiefly for the sake of the pleasant odor imparted to the garments. The perfume called lavender water is a solution of oil of lavender in spirit, along with attar of roses, bergamot, musk, cloves, rosemary and other ingredients, which after standing for some time is strained and mixed with a certain proportion of distilled water. Lavender plants do not thrive as well in America as in English gardens, but succeed best in light, dry, friable soil, well exposed to the sun. They are best propagated by means of cuttings of one year's growth; seeds are unreliable, since they are slow to germinate and usually produce plants of inferior quality. Arabian lavender (*L. stoechas*) yields an oil used in varnish. In California and a few other places in the United States lavender is grown but not on a commercial scale.

LAVENGRO. George Borrow's 'Lavengro,' published in 1851, and its sequel, 'The Romany Rye' (1857), constitute virtually a single work dealing with the author's experiences as a wanderer in England and particularly with his adventures among the gypsies. Within the scope of the picturesque and whimsical narrative is contained a strange medley of novel incidents and curious lore — conversations with apple-women and post-boys and wayfaring priests, much talk of prize-fights and prize-fighters, and many remarkable details of gypsy life and manners. The inimitable personalities of the gypsies, Mr. and Mrs. Petulengro, with whom the author is on terms of intimacy, recur at intervals, and their interesting domestic arrangements, their naïve ideas of morality and their strange dialect afford an abundance of humor. The name Lavengro, word-master, is applied by them to the author because of his knowledge of languages and his interest in the curiosities of philology.

Beginning in 'Lavengro' and running half through 'The Romany Rye' is the delightful episode of the author's encounter with Isopel Berners. Isopel, an Amazon in strength, capable of defending herself against all comers, but dignified, beautifully simple and as pure in spirit as the stars under which she sleeps alone, is a uniquely interesting heroine, and the brief romance between her and the author is handled with a delicacy and charm which ally Borrow with the great masters of English fiction. ‘Lavengro’ and ‘The Romany Rye’ are not as widely read as they deserve to be. Of all books which embody the romance of the open road they are the most delightful. Consult editions of ‘Lavengro,’ with introductions, by W. I. Knapp (1900) and by F. Hindes Groome (1901); Seccombe, Thomas, ‘Isopel Berners,’ selected from ‘Lavengro’ and ‘The Romany Rye’; Walker, Hugh, ‘The Literature of the Victorian Era’ (1042 ff.).

JAMES H. HANFORD.

LAVERAN, lą'vę-räṅ, **Charles Louis,** French military physician: b. Dunkirk, 30 May 1812; d. Paris, 7 Aug. 1879. He was educated at Lille, was appointed assistant at the hospital at Algiers in 1840, and in 1841–50 he was professor at the hospital at Metz. He returned to Algiers in 1850 as professor of epidemiology, director and resident physician of the École Val de Grâce. He served in the Franco-Prussian War as sanitary inspector for the Army of the North, and was for a time in charge of the military school at Montpellier, but in 1872 accepted a call to return to Algiers as chief director of the École Val de Grâce. He was author of many valuable scientific papers, contributed to the ‘Dictionnaire encyclopédique des sciences médicales’ and wrote ‘Traité des maladies et des épidémies des armées’ (8 vols., 1875).

LAVERAN, Charles Louis Alphonse, shärl loo-ē äl-fôṅs lä-vė-räṅ, French physician: b. Paris, 1845. He was graduated at the School of Military Medicine of Strassburg in 1867. In 1873 he was made a member of the faculty of Val de Grâce and after traveling in Algeria to investigate the subject of malarial fever was appointed professor of military hygiene and clinical medicine in that institution in 1883. In 1894 he was appointed director of the 11th corps in the Army Medical Service and subsequently physician-in-chief of the Lille Hospital and member of the French Academy of Medicine. He is an authority on malaria, discovering the plasmodium. His works include ‘Traité des Fièvres palustres’ (1884); ‘Eléments de pathologie medicale’ (with Tiéssier, 1894); and ‘Traité de Hygiène militaire’ (1896). In 1907 the Nobel prize in medicine was awarded him.

LAVERDIERE, lä-vär-dē-är', **Claude Honoré,** Canadian author and teacher: b. province of Quebec, 1826; d. 1873. He was educated for the priesthood, which he entered 1851, and was appointed professor in Quebec Seminary and assistant librarian in Laval University. His claim to recognition rests on the efforts he made to unearth and publish to the world the heroic achievements of early French-Canadian settlers and explorers. His works are of extreme value and interest and include the completion of Ferland's ‘History of Canada,’ the editing of the ‘Jesuit Relations’ and of the ‘Voyages’ of Champlain, with notes and a life of the explorer.

LAVERY, lăv'ĕr-ĭ, **John,** British painter: b. Belfast, 1857. He studied art in Glasgow, London and Paris. His first exhibition of note was his ‘Game of Tennis’ at the Academy in 1886 and in 1888 he received a commission for a painting, ‘The State Visit of Queen Victoria to the Glasgow Exhibition of 1888’ which hangs in the Glasgow Art Gallery. He was elected associate of the Royal Scottish Academy in 1892, of the Royal Academy in 1896, and is also a member of the Royal Hibernian Academy. He is famous chiefly for his portraits and figure-work, although he has accomplished excellent work in landscape and historical paintings. His work is characterized by a free and vigorous line, brilliant execution and exceptional mastery of color harmony. He is especially famous for his portraits of women and a portrait of himself hangs in the Uffizi Gallery, Florence. An exhibition of his work was held in New York in 1915. His work is especially well represented in public galleries, among them the Pinakothek, Munich, the national galleries of Rome, Berlin, Dublin, Brussels and Toronto, Canada, the Philadelphia Gallery, Luxembourg Gallery, the modern galleries at Leipzig, Mannheim and Venice, the New South Wales Gallery, the corporation galleries of Glasgow, Manchester and Bradford and at the galleries in Santiago de Chile and Buenos Aires.

LAVES, lä'vĕs, **Kurt,** American astronomer: b. Lyck, Germany, 24 Aug. 1866. He studied at the universities of Königsberg and Berlin and in 1892–93 he was assistant at the Royal Observatory in Berlin. He has been a member of the faculty of the University of Chicago since 1893, and since 1908 has been associate professor of astronomy there. He is a member of various American and foreign scientific societies and has devoted much time to research.

LAVEZARIS, lä'vä-thä'rēs, or **LABAZARES, Guido, de,** Spanish adventurer: b. Bilboa, 1510; d. Manila, 1580. He sailed on the expedition to Spice Islands under Ruy Lopez de Villabos in 1542 and was prevented from leaving there until 1549 when he went to the city of Mexico. In 1558 he was commissioned by the viceroy, Luis de Velasco, to explore the coasts of Florida preparatory to the dispatching of an expedition for the exploration and conquest of the interior of that country. His principal objective was the searching out of a suitable landing place, and he discovered a bay which he named Filipina, which undoubtedly is Mobile Bay. He accompanied the exploring expedition to Florida under Luna de Arellano in 1559. Upon his return to the city of Mexico he joined the expedition for the conquest of the Philippines, serving as treasurer, and sailed in 1564. He later succeeded to the command of the islands; added to Spanish control the provinces of Pangasinan and Ilocos; and routed the Chinese pirates, compelling them to surrender Manila, which he afterward fortified. Upon the arrival of a regularly appointed governor-general in 1575 his administration was officially approved, and he was granted the honorary title of lieutenant-governor, with salary, which he enjoyed until his death. His narratives of his experiences in Florida and in the Philippines were published by the Spanish government (Madrid 1578).

LAVIGERIE, lä-vēzh-rē, **Charles Martial Allemand,** French missionary: b. Bayonne, 31 Oct. 1825; d. Algiers, 26 Nov. 1892. After passing through the Seminary of Saint Sulpice at Paris he was appointed professor of ecclesiastical history to the Sorbonne in 1853. In 1863 he was made bishop of Nancy, and four years later archbishop of Algiers. His life work began by the establishment of his Central-African mission. On being made ecclesiastical administrator at Tunis he began fighting the slave-hunting and slave-barter which desolated the Dark Continent. For this purpose he agitated in the chief capitals of Europe, and secured pledges from England and Germany to enforce rigidly the anti-slavery article of the Kongo Conference. In 1890 he urged in France the Church's acceptance of the republic, in which counsel it was considered that he was not without the concurrence of Leo XIII. He was made cardinal in 1882. His published works include 'Œuvres choisis' (Paris 1884).

LAVIGNAC, lạ'vēn'yäk', **Albert,** French teacher and critic of music: b. Paris, 1846. He was educated at Paris and in 1882 was appointed professor of solfeggio at the Conservatory, where he later became professor of harmony. Author of 'Cours complet théorique et practique de dictée musicale' (1882); 'La musique et les musiciens' (1895; English ed., 1899); 'Le voyage artistique à Bayreuth' (1897), translated into English as 'The Music-Dramas of Richard Wagner' (1898); 'Les gaités du Conservatoire' (1900); 'Notions scolaires de musique' (1905). He completed in 1913 the first volume of an ambitious undertaking 'Encyclopédie de la musique,' of which he is editor-in-chief.

LAVISSE, lä-vēs, **Ernest,** French historian: b. Nouvion-en-Thiérache, France, 17 Dec. 1842. In 1888 he was appointed to the chair of modern history in the Paris Faculty of Letters and in 1892 was elected to the French Academy. His historical researches have had chiefly to do with Germany, with which country he endeavored to promote more friendly relations; and they are marked by a ripe scholarship which enhances their authoritativeness. Among important works by him are 'The Mark of Brandenburg under the Ascanian Dynasty' (1875); 'Studies of the History of Prussia' (1879); 'Frederick the Great Before his Accession' (1893); 'The Three Emperors of Germany: William I, Frederick III, William II' (1888); 'Political History of Europe' (1890); 'The Youth of Frederick the Great' (1893–1901); a 'Histoire génerale' (with Ramband); a monumental 'History of France' (9 vols., 1900–11); and a volume of 'Souvenirs' in 1912.

LAVOISIER, Antoine Laurent, äṅ-twäṅ lō-rôṅ lä-vwä-zē-ā, French chemist: b. Paris, 26 Aug. 1743; d. there, 8 May 1794. He was the son of a wealthy tradesman; was educated at the Collège Mazarin; studied mathematics and astronomy under Lacaille, chemistry in the laboratory of Rouelle and botany under Jussieu. In 1766 he received a prize offered by the Academy of Sciences (of which in 1768 he became an associate), for an essay on lighting the streets of Paris. Soon after this he traveled through France collecting material from which he constructed the first geological chart produced in that country, during the same period publishing a number of scientific treatises. In 1769 he was appointed one of the farmers-general of the revenue. By means of his wealth and influence he secured special advantages for extending his investigations, which were also stimulated by the new discoveries of Priestley, Cavendish and Black. In 1776 he was director of the government powder-works; sat on the commission of weights and measures in 1790; and in 1791 became commissary to the treasury. In May 1794 he was accused before the Convention as an ex-farmer-general, condemned by the Revolutionary tribunal and guillotined.

To Lavoisier modern chemistry looks as its chief founder; he organized its methods, reformed the old nomenclature and virtually established for this science a new terminology. By his work mainly the old phlogistic chemistry was displaced, and he shares with Joseph Priestley (q.v.) the distinction due to the discovery and analysis of oxygen, to which he gave its name, Priestley having already called it «dephlogisticated air.» «Lavoisier,» says Huxley, «first showed, by the most conclusive experiments, what was really the composition of atmospheric air» (1777). His chief works, as containing his most important discoveries, are his 'Traité élémentaire de Chimie' (1789); and his posthumous 'Mémoires de Physique et de Chimie' (1805). Among his others are 'Sur la combustion en général' (1777); 'Réflexions sur le phlogistique' (1777); 'Considérations sur la nature des acides' (1778); 'Méthode de nomenclature chimique' (with Guyton de Morveau, Berthollet and Fourcroy, 1787). His complete works were published by the French government under the title of 'Œuvres de Lavoisier publiées par les Soins de son Excellence, le Ministre de l'Instruction Publique' (6 vols., 1864–93). There are many accounts of his life and work. Consult Grimaux, 'Lavoisier d'après sa correspondance, ses Manuscrits, ses papiers de famille et d'autres documents inédits' (Paris 1888); and Schultze, 'Lavoisier, der Begründer der Chemie' (Hamburg 1894); Thorpe, 'Essays in Historical Chemistry' (New York 1911).

LAVROV, läv-rŏf', **Peter Lavrovitch** (Mirtov), Russian revolutionist, scientist and scholar: b. province of Pskov, 2/14 June 1823; d. Paris, 6 Feb. 1900. He received a military education at Saint Petersburg and became colonel of artillery and instructor in mathematics at the Academy of Artillery, remaining there for 22 years. It was not until 1862 that he joined the Land and Liberty party, thereby identifying himself with the revolutionists. He was arrested for his political activities in 1866 and in 1868 was sentenced to banishment in the Ural Mountains. He succeeded in making his escape to France and settled in Paris. He was elected a member of the Society of Anthropology in Paris in 1870, and in 1871 he was in England and Belgium as a representative of the Paris Commune. He founded and edited, 1873–77, a Socialist periodical, *Forward,* in which he gave particular consideration to Russian politics. Before leaving Russia he had contributed extensively to the literature of the revolutionary movement, and he now continued anonymously to contribute to various publications in its interest. He was well grounded in history, science, philosophy and psychology and spent the greater part of his time after leaving Russia in writing. His political pamphlets are voluminous in number and made him widely popular in Russia, because of their clarity, sanity and belief in the power of the people through education to bring about the reforms he so earnestly advocated. Author of ‘The Hegelian Philosophy’ (1858–59); ‘An Attempt at a History of Modern Thought’ (2 vols., 1859); ‘Outline of the Physico-Mathematical Sciences’ (1866); ‘Historical Letters’ (1879), etc.

LAW, Andrew Bonar, British statesman: b. New Brunswick, Canada, 16 Sept. 1858. Educated in Canada and Glasgow, he engaged in the iron business in the latter place and acted as chairman of the Scottish Iron Trade Association. He entered Parliament as Unionist (Conservative) member for the Blackfriars division of Glasgow in 1900. He was defeated in the January 1906 election, but found a seat a few month later for Dulwich. In 1910 he contested Northwestern Manchester on a straight Tariff Reform issue, but lost. In 1911 he was returned for the Bootle division of Lancashire, which he has since represented. Between 1902 and 1905 he was parliamentary secretary to the Board of Trade. Since the resignation of the Balfour Cabinet in December 1905 the Unionists have been in opposition; owing to the war no election was held in 1915, but in that year a coalition ministry was formed and Mr. Law became Colonial Secretary. He had succeeded Mr. Balfour in the leadership of the Unionist party in 1911. In 1916 he succeeded Mr. Lloyd George as Chancellor of the Exchequer, the latter becoming Premier in the place of Mr. Asquith.

LAW, Edmund, Anglican bishop: b. Cartmel, Lancashire, 6 June 1703; d. Rose Castle, Carlisle, 17 Aug. 1787. He was educated at Saint John's College, Cambridge, and was later elected a Fellow of Christ's College. He became rector of Graystoke, Cumberland, in 1737, and was made archdeacon of the diocese of Carlisle in 1743, which office he resigned upon his becoming master of Peterhouse in 1756. He was appointed *proto-bibliothecarius* at the University of Cambridge in 1760, and in 1764 he was made Knightbridge professor of moral philosophy. In 1768 he became bishop of Carlisle. His writings are characterized by a broad religious toleration, and he regarded his appointment to a bishopric as a proof that freedom of religious inquiry was not rebuked. Besides translations and numerous religious papers he wrote ‘An Enquiry into the Ideas of Space and Time’ (1834); ‘Considerations on the State of the World with Regard to the Theory of Religion’ (1745), etc.

LAW, John, of Lauriston, Scottish speculator: b. Edinburgh, 21 April 1671; d. Venice, 21 March 1729. His father was a goldsmith in Edinburgh. He was educated at Edinburgh University, where he was remarkable for proficiency in arithmetic and algebra. He early migrated to London deep in debt, and while in that city killed a man in a duel, but managed to escape to the Continent. He returned to Scotland in 1700, and the following year proposed to the Scottish Parliament the establishment of a bank with paper issues to the amount of the value of all the land in the kingdom and the abolishment of the farming of the revenues; but his scheme was rejected. The years from 1708 to 1715 were spent on the Continent, and his success as a gambler caused him to be banished from Venice and Genoa as a designing adventurer. He accumulated a large fortune by gambling, and at length secured the patronage of the Duke of Orleans, regent of France, and in company with his brother, William, established his bank in 1716 by royal authority. It was at first composed of 1,200 shares of 3,000 livres each, which soon bore a premium. This bank became the office for all public receipts; and there was annexed to it a Mississippi company, which had grants of land in Louisiana, and the exclusive right of trade in that territory for 25 years, and of receiving and exporting the beaver skins of Canada, and it was expected to realize immense sums by planting and commerce. In 1718 it was declared a royal bank, and shares rose to 20 times their original value. A vast quantity of paper money was issued, the credit of which was unquestioned, whilst the national bonds remained at a price far below their nominal value. In 1720 Law became a Roman Catholic and was made a councillor of state and comptroller-general of the finances; but the shares sank in value as rapidly as they had risen. He was obliged to resign his post, after five months, and for personal safety to quit the kingdom. (See MISSISSIPPI BUBBLE). He lived afterward in great obscurity, finally settling in Venice, and died still occupied in vast schemes, and fully convinced of the solidity of his system, the failure of which he attributed entirely to enmity and panic. Various opinions have been entertained of the merit of his project, and by some it has been thought to have possessed feasibility, had it been carried more moderately into practice. A volume entitled ‘Œuvres de J. Law’ was published (1790). Consult Wood, ‘Memoirs of the Life of John Law’ (1824); Mackay, ‘Memoirs of Extraordinary Popular Delusions’ (1850); Thiers, ‘Histoire de Law’ (1858); Weston-Glynn, ‘The Financier Law: his Scheme and Times’ (1907).

LAW, John, American lawyer: b. New London, Conn., 1796; d. Indiana, 1873. He was graduated at Yale and admitted to the bar in 1817, but soon after emigrated to Indiana, where he settled at Vincennes. He was quickly brought to the front as a lawyer; became successively prosecuting attorney, judge for eight terms and in 1838 receiver of public moneys. In 1855 he was appointed judge of the Court of Land Claims. He afterward served in the 37th and 38th Congresses on committees of library, agriculture and Revolutionary pensions. He was descended from a long line of lawyers, which included the chief justice of the Connecticut Supreme Court, Jonathan Law, and was president of the Indiana State Historical Society.

LAW, William, English clergyman and writer: b. King's Cliffe, Northamptonshire, 1686; d. there, 9 April 1761. He was graduated at Emmanuel College, Cambridge, in 1712, having been ordained and elected a Fellow of his college in 1711. He afterward lived at Cambridge, tutoring and occasionally acting in his capacity as a clergyman. His loyalty to the Stuarts prevented his taking the oath of allegiance to George I, and he was deprived of his fellowship. He is thought afterward to have become a curate in London, but from 1727 he was a member of the household of Edward Gibbon, grandfather of the historian, as tutor and spiritual adviser. His influence extended over a widening circle of friends, among them Charles and John Wesley, and Archibald Hutcheson, M.P. from Hastings. His writings extended his influence over a wider sphere, Dr. Samuel Johnson, Lord Lyttelton, Bishop Horne and others attesting the worth of his teachings. In 1740 the Gibbon household was broken up and Law returned to his house at King's Cliffe. There he was subsequently joined by the wealthy widow of his old friend, Archibald Hutcheson, who had counselled her to place herself under Law's spiritual guidance and by Miss Hester Gibbon, sister of his former pupil, who also possessed considerable means. The three formed a household devoted to the following of Law's famous book, ‘The Serious Call to a Devout and Holy Life,’ spending most of their income in charity, and their time in religious study and devotion; an arrangement which continued until Law's death, 21 years later.

As a writer Law had among his contemporaries no rival except Richard Bently in the field of controversy, always supporting the High Church party; while in matters of practical divinity his influence was indisputable. The Wesleys, however, broke with Law after his teachings and writings began to evince a tinge of mysticism. This tendency appears to have been the outgrowth of his admiration for the Teuton theosophist, Jacob Boehme, although Law was by no means a disciple of that writer. Author of ‘Three Letters to the Bishop of Bangor’ (1717); ‘Remarks on Mandeville's Fable of the Bees’ (1723); ‘Treatise on Christian Reflection’ (1726); ‘Serious Call to a Devout and Holy Life’ (1728); ‘Case of Reason’ (1732); ‘An Appeal to all that Doubt and Disbelieve the Truths of the Revelation’ (1740); ‘The Way to Divine Knowledge’ (1752); ‘Dialogue Between a Methodist and a Churchman’ (1760), etc. Consult Overton, J. H., ‘Law, Non-Juror and Mystic’ (1881); Walton, C., ‘Notes and Materials for a Complete Biography of W. Law’ (1848).

LAW (M.E., *lawè*; A.S., *lagu*). The Anglo-Saxon form is of rare occurrence, except in compounds; but from these, and from the cognate Icelandic *lŏg*, pl. *lag* — i.e., «things lying in due place,» like strata of slate, for instance — the original meaning of *lagu* as, «that which lies in order,» is inferable. The transition of the idea to sheets of parchment or other material, upon which an order is inscribed, and, ultimately, to that which had been written, ordered or ordained, could not have been difficult. The derivation of the English word «law» from the French *loi* (Norm. Fr. *lay*) or from the Latin *lex, lego,* is incorrect. But the Latin and Teutonic words evidently come from the same Aryan root (*lagh*, to lie). The oldest meaning of *lex* was «a bill» — probably so called because it was *laid* before the people in *comitia* for approval (cf. Ger. *vorlage,* a bill). When a *lex,* or bill, had been agreed to it was still called a *lex,* just as we speak of a «McKinley Bill» or a «Hepburn Bill,» even when it has become an act of Congress and been a law for many years. This word-history shows that the term «law» is used in its original and proper sense only when it is used as the generic name for that which has been ordered and made applicable to the conduct of human beings. In mediæval times animals were regularly tried and condemned for their defaults and we still speak of trivial and defective evidence as «insufficient to hang a dog.» This practice of trying and passing judgment on dumb creatures, however, was an aberration. When ancient law declared forfeited an animal or inanimate object, which had caused the death of a person, it was a liability of the human owner of the offending thing that was enforced. When a well was filled up because a child had been drowned therein, this was a penalty enforced upon the owner of the well; when an ox was made to furnish forth funeral baked meats for the relatives of the man whom the animal had gored, it was at the cost of the owner of the ox — the owner, not the thing that had caused a mischief, was responsible to the law. In admiralty practice ships are made defendants in actions for debt and are libelled in suits for damages, just as if they were persons, but the liability enforced in every case is that of the master or owner of the vessel. A law, therefore, is a rule of *human* conduct. This being so the inappropriateness of the term, «laws of nature,» in its modern sense, becomes apparent. Records of natural phenomena and their sequences, though set down with mathematical preciseness and logical perfection, are not *rules* of conduct at all; they are descriptions. The statement that «an apple falls to the ground from a height of 15 feet in one second,» is not a «law» of gravitation, but a fact — just as if one should say «he stole,» one would merely be describing an act. The commandment, «thou shalt not steal,» however, is a law. The distinction is obvious. Mathematical laws are *rules* of *quantity,* not of conduct. In the domain of æsthetics such terms as the «law of beauty» or the «law of harmony» are familiar expressions; but these, like all the others mentioned, are «laws» merely in figure of speech. Terms like «Grimm's law,» the «laws of phonetics,» or the «laws of metre,» are justified, because they are rules of human conduct in the use of language, having their origin in custom. The commandment «thou shalt not covet» is a rule of ethics, a moral precept and also a law; but the science of ethics is concerned with resolutions and operations of the human will, or with states of mind, which have not found expression in action. The rules of this science, therefore, are not, properly speaking, laws. Covetousness is a sin and invites no legal penalty until it has manifested itself by the infraction of some legal right. Law is a rule of conduct governing *external* human acts. Speaking and writing are actions, but thinking is not an external act and a mere inclination to do is not an act at all.

Rules of human conduct are most varied in their origins and degrees of sanctity. The "laws of etiquette" and "fashion" need not be observed by anybody who has no fear of being laughed at for his oddity or of being shunned for his boorishness; yet few laws are more generally and more willingly obeyed. "Nobody," as Locke remarks, "escapes the punishment of their censure and dislike who offends against the fashion and opinion of the company he keeps." He would be a brave man who should defy a college class custom by supplanting the members at a club table, and the rules of the Stock Exchange are better enforced than some statutes. The "laws of honor" have points of exceeding delicacy and "conduct unbecoming a gentleman" could be such as neither ordinary morality nor common custom would condemn. Though not enforceable by law, "debts of honor" are more scrupulously paid than commercial obligations. The rule of the "code of honor," that duels may be fought only among equals, has an interesting parallel in early English criminal procedure, which allowed trial by battle on an appeal for assault and wounding only when the wounds were caused by sharp weapons, such as would be borne by gentlemen. An injury done with a cudgel, and, presumably, inflicted by a churl, gave merely a right of action for damages. The special rules of conduct above mentioned (and many others of like character) are outgrowths of custom and have their sanction in the general opinion of the larger or smaller classes of persons who observe them. But practically the whole body of human law grew up in the same way and had the same point of departure. Customs, indeed, were not merely the sources, they were the law itself. Insofar as the commands of the patriarchal or patrician chiefs of early societies were not arbitrary expressions of irresponsible power, they recorded only rules of conduct that had become habitual in the tribe or clan. Legislative promulgation of these customs was an unessential formality. Their general observance was proof of their existence. General observance also proved that they had the sanction of public opinion and that they were matters of common knowledge. No man, as Dr. F. J. Stimson remarks, had to be told what the law was; everybody knew the law just as he knew hunting or fishing. It was the business of nobody in particular to compel obedience to the law. When a man's enclosure was broken into, his house set afire or the lives of his family menaced, he did not run to a judge for advice nor call in the sheriff and his posse. He repelled any attack with his strong right arm and, if an assailant was killed, the resulting lawsuit would not be concerned with assigning a penalty for the violation of a custom by the attacking party; the question would be whether the defender of his home and his customary rights should suffer any penalty for killing a lawbreaker. In fact, the fear of being killed in the act of violating another's rights was the only real restraint upon lawbreakers in early times. In our own "Wild West" the rule was "Shoot first, then palaver." At the stage of social development here spoken of law would be definable as a rule of conduct governing external human actions, sanctioned by public opinion and enforced by individuals with the acquiescence of the community. The idea of a law as a rule promulgated and imposed by legislative act, and enforceable only by the public authorities, was a later conception — meaning later in the stage of social growth, not later in historic time. Some communities had laws in the strict sense of the word thousands of years before others.

Early Codes.— The earliest known system of secular law is contained in the legislation (circa 2350 B.C.) of Hammurabi, king of Babylonia, who was a contemporary of Abraham and of Chedorlaomer the Edomite. This legislation took the form of a code of 282 paragraphs, regularly arranged under heads and subheads, dealing with the rights of persons, property, the family, contracts, torts and procedure in a very adequate manner. It forbade widows to remarry, without first making provision, under the direction of a judge, for the care of her deceased husband's household and children; it penalized surgeons for injuries done by them in unsuccessful operations, and various other tradesmen for damages caused by their neglect. It demanded retribution, "an eye for an eye, a tooth for a tooth," in the very words of the Levitical law made over a thousand years later. It was a civil code throughout, containing no religious ordinances; in fact, it transferred the judicial function from the priests to the elders. The idea of the Single Taxers that land held out of use should be burdened as heavily as land under cultivation was anticipated by 4,000 years. The assumption would be unwarranted that a code, which reflects an advanced social order and rather complex economic conditions, was evolved out of the innermost consciousness of a lawgiver. On the contrary, it is a reasonable supposition that the Babylonian codifiers did little more than restate, in orderly form, an existing body of customs. The transition from unwritten customs to written code marks a stage in the history of almost every juristic system. As human societies developed and human relations increased in complexity so did the rules for the government of human conduct; a few simple customs, with which everybody was familiar, no longer sufficed. Knowledge of the law became the privilege of a class — of a priesthood or a military and political aristocracy. Various motives impelled these privileged repositories of legal knowledge to part with a monopoly so advantageous to themselves. The religious oligarchies of Asia embodied their legal learning in codes either for their own guidance, to relieve their memories, or to instruct their disciples. The opportunity incidentally afforded them to magnify and consolidate their influence was too tempting to be resisted and their monopoly of knowledge enabled them to pass off on the public collections, not of rules actually observed, but of rules which the priestly order thought proper to be observed. Such a collection is that known as the Laws of Manu. The claims to the highest antiquity made for this Hindu code are not well founded — and, while it is evidently of

Brahmanical origin and enshrines many genuine observances, it does not embody a set of rules that were followed, as a whole, anywhere in India. It gave general sanction to localized cruel practices, like the suttee, and it hardened the law of status into the abhorrent social institution of caste. Another reason for codification may be found in territorial expansion through conquest. This probably was the motive for the compilation of the early Babylonian code. Hammurabi had forced his sovereignty on Assyria and would, naturally, desire all his subjects to obey one law. The writing down of the laws of Minos, additional fragments of which have recently been found in the Gortyna inscriptions, was probably similarly influenced — Minoan sovereignty having been extended over practically all the city-states of Crete. Lycurgus of Sparta took from these laws the institution of the *syssitia* — public tables at which all citizens dined in common — and also their general policy, which was to train and control, not only the young but mature citizens as well, in all the habits and relations of life from the cradle to the grave. This policy comported with the purpose of Lycurgus to create an invincible military machine. The laws of Sparta cultivated the soldierly virtues at the cost of nearly everything else. A warrior who returned from battle without his shield suffered disgrace, ineffaceable during life, and scarcely effaced by subsequent death in the performance of a distinguished heroic action. A Spartan boy, on the other hand, was encouraged to practice dissimulation and to appropriate whatever he desired and was disgraced for lying and stealing only when caught at it. Aristotle damns the Minoan law with faint praise and, if its moral level was no higher than that of the Spartan institutions, the high respect accorded to the former by the ancient Greeks seems hardly deserved. But the 180 or more codes of the Greek cities and their colonies in Asia, Africa, Italy and Sicily were not, generally speaking, inspired by the desire to confirm and perpetuate the power of a ruling class. On the contrary, they were usually the outcome of successful assaults by the plebeian or popular elements of the community on the aristocratic repositories of legal lore and on the latter's monopoly of knowledge. The rules of conduct were graven on stone or written on scrolls, so that they might be known to all whom they concerned and who were expected to observe them. The communities in which they were promulgated were fairly advanced in their institutional development and familiar with rules of conduct imposed by public authority and enforced by a public magistracy. This ideal was fully realized by the promulgation of a written law.

The Civil Law.— The Roman Law of the Twelve Tables, more clearly than some other of the codes mentioned, was the fruit of a popular revolt against the legislative monopoly of a class. The institution of the tribunate had subjected the pronouncements of the patrician Senate to the veto of a popular representative; the Publican Law had given the plebeians the right to make laws in their own assemblies; finally the Decemvirate was established for the express purpose of ordering and declaring a law which should be applicable to all citizens of Rome, and known to all through its publication. When its task was completed, the Decemvirate was dissolved. One should not expect these early collections to be codes in the modern sense. Solon's Constitution of Athens had but little order and usually these compilations mingled religious and civil ordinances and moral precepts without regard for their essential differences in character. The Roman code is a mere enunciation of customs existing at a time when Roman society had barely emerged from the intellectual condition in which religious duties and civic obligations are invariably confounded. Its provisions respecting contracts, and many other things, might have more properly found place in a book of rites than in a book of laws; and it embalmed cruel and superstitious practices. The body of a bankrupt might be cut up and divided among his creditors. The inflexibility of a code would not at first be regarded as an evil comparable with the evil of living under a law held in guardianship by the privileged few and altered by these at will to suit their purposes. Their strict adherence to the letter, moreover, enabled the Romans to preserve their legal institutions intact amid great social changes and to avoid the dangers of a too rapid development — such as reduced some of the Greek codes to formlessness and made the law as administered by Athenian juries, for instance, very little better than the rule of the mob. When the Roman jurists had to adapt their code to new circumstances they did so with great caution and, at the outset, by legal fictions. These *fictiones*, as they were called, while concealing, or affecting to conceal, any change in the letter of the law, permitted a change in its operation or direction. For instance, the *jus civilis* (literally the law pertaining to citizens) gave strangers no standing in court. But justice could not be denied to the great number of aliens who had flocked to the city; so a rule of pleading was made that a plaintiff might aver his citizenship and that this averment could not be traversed, even though it might be untrue. The form of marriage known as *usus* required continuous cohabitation for one year to establish the relation with all its legal consequences; a woman thus married (and *usus* became the prevalent form of marriage) could, by absenting herself from the marital domicile for one day in each twelvemonth, defeat the law which gave the husband absolute power over the person and property of his wife. The legal fictions were many. In their *responsa prudentum*, learned jurists applied the law in a sense other than literal. But a more effective solvent of the harshness of the code was *equitas*. This was an outgrowth of the *jus gentium*. The Prætor annually published an edict (it afterward became perpetual) containing a statement of the law which he proposed to apply in the cases of foreigners seeking justice in the courts of Rome. The prætorian edict was a collation of alien laws on various topics which seemed likely to be brought into judicial consideration. In the beginning the edict was a contemptuous concession to the *gentiles;* but the uniformity of the legal rules on given subjects, though drawn from many and quite unrelated sources, could not fail to become impressive. It seemed reasonable that rules, which served the ends of justice between Syrians, Egyptians, Gauls and Greeks, would produce equitable results also when applied to Romans. If strangers could transfer all kinds of property by simple delivery, or could make contracts by simple memorandum, by letter or by word of mouth, why should a Roman be obliged to go through an elaborate ceremonial, which had become meaningless and superfluous, in order to achieve the same purpose? While the rules of equity, which were published by the Prætor from time to time and added to the perpetual edict, could not supersede the rules of law, they could, and did, make the latter inoperative. A Roman woman and her property might still be left (by the law) in lifelong wardship of her male relatives; but a rule of equity would enable her to snap her fingers at her guardians by recognizing her right to use and dispose of that which was hers as she wished. Wills originally could be made only in the presence, and with the consent, of the *comitia calata;* they might be regarded, therefore, as special acts of legislation. The object of a will was to enable a father to direct who should be his heir and thus to defeat the law of inheritance which made an emancipated son incapable of taking his heritage by regular legal succession. The Prætor, however, actively intervened to prevent the abuse of testamentary power. An «undutious will» could be set aside and any disposition of the patrimony contrary to the equitable rights of a wife or children would be disregarded. There was comparatively little legislation affecting private Roman law until the time of the later emperors. But the fictional and equitable exceptions ultimately became the rules and the moral speculations of the Greek philosophers exerted a profound influence. Aristotle mentions a distinction between written law and «the law which is according to nature and immutable.» The Stoics habitually opposed to the law imposed by human authority «the common law, which is the right reason, and which pervades all things.» In the same strain, Cicero speaks of law, as «implanted by Nature, commanding those things which ought to be done and prohibiting the reverse.» This «highest law,» he says, «was born in all ages before any statute was written or any state was formed.» The Roman lawyers had already perceived a material unity in the laws of all nations in their contemplation of the *jus gentium;* they were well prepared, therefore, for the reception of the ideal of a universal law, to which all legal systems tend and to which they should conform — and which has its basis in an all-pervading sense of justice. This conception of a «law of nature» is a little different from and more rationalistic than that of the moral philosophers. And it led to an ever-increasing conformity of the *jus civilis* to natural ideas of right and the elimination therefrom of unreason and non-essential formality. The development of the *jus civilis* was complete in the time of Hadrian; the codification of Justinian, four centuries later, was little more than a recension. It became practically a universal law when Caracalla's decree enabled every inhabitant of the empire to say «civis Romanus sum,» and the distinction between citizens and gentiles ceased to exist. Its general provisions, regulative of the rights of property and of persons in their private relations to one another, have since been bettered in only few respects and have deteriorated in some. The original barbarity of the *patria potestas* had been refined, so that the power of the father over the persons of his children had been reduced to a conditional veto of their marriage, while his power over the property of unemancipated sons was modified through the general practice of emancipating them when they had attained the age of discretion. Children, irrespective of sex, shared equally in the patrimony, though the estate might be held in trust by the general heir appointed by will. Marriage, resting on the consent of the married, it was considered «immoral» to hold the parties in the bonds of matrimony when *consensus* no longer was present. Milton postulated his theory of divorce on the same premise and the doctrine is really not more shocking coming from a heathen Roman lawyer than from an English Puritan pamphleteer. The *jus civilis* gave more freedom to women, married or unmarried, than most modern laws do; but it recognized chattel slavery.

The Feudal System.— The barbarian eruption broke the continuity of the development of the law on a Roman foundation. The customary laws of the Teutonic invaders were modified here and there through contact with the Roman system. Theodoric the Goth had received his education at the imperial court at Constantinople; but the Ostrogothic kingdom of Italy was too short lived to permit the growth of a Romanized system of Teutonic law. The Forum Judicum is the only extant code in which a fusion of the two systems was made with a measurable degree of success. This code was framed (649-652 A.D.) during the reigns of Chintasvintus and Recesvintus, two Visigothic kings in Spain, and is a combination of the Visigothic laws, reduced to writing in the second half of the 5th century by Euric at Arles, and of the Breviarum Alaricum, compiled from the Roman codes at the beginning of the 6th century. The Visigothic kingdom was overthrown in 711, but its code was adopted by Ferdinand III of Aragon about 1350. The Christian Church introduced and administered the Roman law of inheritance and of marriage and the family — modified by Christian concepts and the Levitical canon — and influenced the embodiment of the principle of the widow's dower into the customary law of all western Europe. In almost all other respects, however, the rupture with the past became complete when the feudal system had become firmly established. The exclusive right of the first-born to the succession and the rules for the entailment of estates were originally promulgated in the «house laws» of the great feudatory chiefs, who compelled weak sovereigns to incorporate them in their land grants; but these regulations did not have long to wait for their embodiment into the customary law. On top of the institution of chattel slavery, or serfdom, feudalism imposed the institution of villeinage, with the right of the lord to heriots and unpaid forced labor. While the right of unmarried women to hold property, as recognized by the Roman law, was continued, the property of a married woman passed absolutely under the dominion and ownership of her husband. As a legal person a woman ceased to exist when she became a wife. When European society worked its way out of these conditions, after centuries of struggle, it was with little help from the Roman law. There was no central source of authority. The empire of the Franks fell to pieces after the death of Charlemagne and the mediæval empire of the Germans, sometimes called "Holy" and "Roman," was a mere thing of parchment and ink. It was not recognized in France after the 10th century. Germany from the beginning was a loosely-knit aggregation of duchies, whose chiefs were as often at war with the Kaiser as in his allegiance. The grand seigneurs of France were more powerful than the king. Conditions were not propitious for the development of a common law and became less so as political and class divisions grew smaller and more numerous. The organization of secret courts (Ger. Vehmgerichte) whose judgments, made in the dark, were executed in the dark by the daggers of oath-bound brotherhoods, was only one of many indications of the general lawlessness. What law developed was of limited application with respect to the territory, or the social classes, affected. Every province in France had a different legal system, every German principality had its "Landrecht"; every incorporated city had its "liberties," every guild its institutions and ordinances, and every robber baron was a law unto himself. A *lex maritima* was developed for mariners and over-sea traders, and a *lex mercatorum* for merchants. The two last named had some claim to universality, for they were observed, by the classes for which they were made, throughout Europe, irrespective of nationality and were administered and enforced by special courts. Their basic principles were taken from the Roman law, as were those of the all-pervading canon law, and in these three systems the *jus civilis* manifested the most of its posthumous power.

The revival of the study of the *corpus juris civilis* at the University of Bologna and other seats of learning toward the end of the Middle Ages produced a flow of knowledge in many streams. But human societies were becoming nationalistic and patriotic; the universities were cosmopolitan and scholastic, with little sympathy for the new spirit that was actuating the nations of western Europe. It is not surprising, therefore, that the product of the new learning was a groundwork of ideas rather than a body of laws; academical theorizing that led to nothing practical. Neither is it surprising that the finest fruits of the legalistic renaissance were works on international, rather than civil, law. Grotius' treatise "De Mare Liberum" has its basis in the Roman law of the freedom of navigable waters; his "De Jure Bellum et Pace" is a negation of the Roman rule that enemy property (invaded territory included) is "ownerless"—just as wild animals are—and, therefore, subject to capture and appropriation by the captor. The Reformation in Germany in its political aspects was mainly a struggle for legal order—on the part of the burgesses for a supreme imperial law; on the part of the peasants for liberation from feudal serfdom. The struggle was bootless. The *corpus juris*, indeed, became authoritative, when it was not in conflict with local law, but German peasants remained serfs for three more centuries. France, notwithstanding the consolidation of the monarchy, remained under the curse of an anomalous and discordant jurisprudence. The south continued to be the *Pays du Droit Ecrit;* the north, the *Pays du Droit Coutumier;* but province differed from province. One influence might have been exerted for betterment. The French lawyers had attained a political and social position beside the feudal nobility; they were organized in great chartered corporations with large powers and larger claims; they excelled their compeers throughout Europe in the qualities of the advocate, legislator and judge; their generalizations displayed an elegance of diction and a refinement of logic, unexampled since the passing of the jurisconsults of ancient Rome. But not one venerable or lucrative quiddity would they sacrifice in the interest of legal harmony and clarity. For the "law of nature" they developed an almost passionate admiration. It overlapped all provincial boundaries; it did not distinguish between noble and burgess, nor between burgess and peasant; it exalted lucidity and system—and it did not commit its devotees in any specific improvement. Affecting to believe that the vices of the French law were ineradicable, the legal profession obstinately resisted the reform of abuses. Montesquieu tried to instill a different spirit, but French law was to be purified in the fires of the Revolution.

English Legislation.— In England the evolution of a homogeneous legal system was favored by the concentration of the law-making power. As early as the 13th century the common law was centralized in the King's Court; and it was the law spoken by the king's judges. There was no other school; and there was no other masters from whom it could be learned. The systematic study of the Roman civil law was discouraged, and, finally, its citation as precedent was interdicted. The courts, making law by working on material presented for their consideration, demanded skilful pleaders—and in the course of a few generations a learned profession arose and became established in the societies of the inns of court. The processes whereby the English law was adapted to the changing needs of society were much the same as those which had been employed in Rome a thousand years before. By the legal fiction of levying a fine and suing for a common recovery the strictest entail could be broken; by the transformation of a tenure in fee into an equitable use, an inalienable feudal benefice became property, which could be conveyed by deed or devised by will; by the substitution of money for personal labor in the payment of rent, and the recognition of leases as freeholds, the tenants became freeholders and, consequently, free men. The law did not permit married women to own personal property; but equity enabled them to hold any kind of property in trust for their own benefit, and to dispose of the same at pleasure. The private law remained mostly unwritten until modern times. All the statutes enacted between the time of the Conquest and the time of the Commonwealth, embracing topics of the private law, would scarcely cover 30 printed pages of an ordinary law book. The Statute of Merton (1233) declared it to be the English law that children born out of wedlock could not be legitimized by the subsequent marriage of their parents. The Statute of Merchants (1285) authorized the imprisonment of insolvent debtors, but it also provided that the goods of travelers who died while passing through England could not be seized and withheld from their heirs — in which respect English law was centuries in advance of that of the Continent. The guilds, generally speaking, were treated with consideration, though there were several statutes prohibiting and penalizing restraints of trade and combinations to unreasonably enhance prices. Artificers, however, received much unfriendly attention from the law-makers. In 1304 a combination to bring about, *by lawful means*, an injury to a third person was declared conspiracy; in 1360 all "alliances and covins" between masons, carpenters, etc., were declared void; the act of 1452, empowering the Chancellor to issue writs of proclamation against disturbers of the peace, and to punish disobedience by outlawry, is believed to have originated the suppression of strikes by injunctive order. The Statute of Victuallers (1548), while it gave freedom of employment to skilled mechanics in any town, forbade artificers to form oath-bound confederacies not to work, or to make agreements among themselves as to hours of labor. In 1349, and persistently for 100 years thereafter, efforts were made to fix wages by law; and they were abandoned only when masters complained that they could get no servants unless they paid more than the statutory wage. Worst of all fared the agricultural laborers or villeins. They were committed without bail by any justice of the peace for refusing to work. Wat Tyler's rebellion (1383) was a plebeian revolt, and among the demands of the rebels was one that labor in husbandry be commuted to a money rent. In part the demands were allowed. Villeins were thereafter paid wages, but the act of 1585 restricted them to labor in their hundreds and required them to follow the calling of their fathers. Villeinage was formally abolished in 1425, but as late as 1574 commissioners were appointed by Queen Elizabeth to manumit bondmen and bondwomen. The Statute of Labor, passed (1562) in the reign of Elizabeth, required unmarried artisans with incomes of less than 40 s. to serve at their handicrafts. Persons under 30 having no trade could be compelled to labor at the request of any person having an art or mystery; all persons between 12 and 60, not otherwise employed, might be compelled to labor at husbandry. Employment was for a year and masters could not dismiss, nor servants leave, without good cause. Unskilled and agricultural laborers could not depart from the parish without the certificate of a constable and two good citizens. The wages of artisans were fixed by justices of the peace. The statute against the monopolies by royal patent was passed in 1623, after 50 years of shilly-shallying by Elizabeth and James. Feudal tenures were abolished by a statute of Charles I.

Era of Rationalism.— Philosophy in the 18th century had become a rationalistic idealism. Every philosopher, moreover, was duplicated as a publicist, seeking new principles on which to base a reconstituted social order. Man, in a state of nature, was imagined to have lived under conditions of almost absolute liberty. Society was assumed by Rousseau to have been established through a "social contract," whereby each individual surrendered only so much of his complete freedom as was necessary to the enjoyment of the equal right of every other individual to perfect liberty of action. To ensure this equality was considered the only function of government. This was the theory; what were the facts? The political condition of France was that of a feudal aristocracy, succeeded, when the Revolution had been accomplished, by an imperial despotism with a limited elective franchise. The population was largely agricultural; the burgesses were mostly engaged in petty industry. Land was burdened with feudal charges and movable property practically non-existent. Legal relations between persons were few and well-defined, and were wholly individualistic. Unrestricted private ownership was considered the basic principle of private law. The propertyless workingmen were disunited and ignored. "Egalité" was understood to mean political equality. During the whole revolutionary period legislation was regarded the only right source of law. Legislators, however, were not expected to weigh the morality of each individual action; if the law secured a maximum of liberty to each, that was sufficient. Everybody favored a code — the economist-philosophers because it tended toward a desired harmony and universality of legal principles, not because they believed a perfect system could be created at one stroke. They were rather partial to the *coutumes*, which they deemed to reflect present social needs more nearly than the *jus civilis*. But when the radicals had obtained supremacy in the convention all previous legislation was pronounced barbarous and uncivilized. Cambacérès and a legislative commission were directed, in 1793, to prepare a brief code. The first draft was rejected as too complicated. The second effort of Cambacérès, "The Code of Nature, Sanctioned by Reason and Guaranteed by Liberty," was criticised as a mere table of contents. It was under the Consulate that codification was finally accomplished. Tradition had reasserted its power; it was agreed to retain what was good from the past; land was to be unburdened of feudal obligations and no inequalities growing out of personal status could be tolerated; but, otherwise, the code prepared under the supervision of Portalis was a compromise between the customary and civil laws. The "Code Civil" was to be regarded as a book of institutes, rather than as a book of laws. In the report accompanying the draft, Portalis remarks, that it is impossible to provide for everything in advance; much must be left to usage, the discussion of learned jurists and the decision of judges. The function of a statute is to fix, in broad lines, the general maxims and to establish principles that will be fertile in consequences; to descend in detail to every question that might possibly arise would not be conducive to the required simplicity and lucidity. The liberty of the individual — who is assumed, with respect to his private affairs, to act in his own interest and not the interests of the public — remained the ideal. The absolute right of private ownership and freedom of contract were the cornerstones of the edifice. In England the first effect of the French Revolution was reactionary and quiescent. The Combination Act of 1800 outlawed workingmen's associations, transitory or permanent, which had for their object the increase of wages or other regulations of the terms of employment. Any person offering to assist in the maintenance of a strike might be proceeded against summarily before a peace officer. The Health and Morals Act of 1802, though an emergency law called forth by an epidemic, may be regarded as the beginning of factory legislation. The slave trade was prohibited in 1806; the whipping of women at the pillory for misdemeanors was abolished in 1820, and in 1822 the first law for the prevention of cruelty to animals was passed. The era of individualistic and utilitarian law reform (1825–70) was ushered in by the writings of Jeremy Bentham and was dominated by his ideas. According to Bentham, legislation is a science; its aim is to carry out the principle of utility, hence the proper end of every law is the greatest happiness to the greatest number. Every person is, in the main, the best judge of his own happiness; hence, all restrictions on free individual action, which are not necessary to the security of like freedom to other persons, should be removed. Maine's aphorism that, «modern law substitutes contract for status,» embodies the fundamental conception of the Benthamite Liberals, who regarded the unrestricted exercise of the right of contract as the most satisfactory way of disposing of the whole body of antiquated legal institutions. The British utilitarians, like the French rationalists, fell short of the conception that possession and ownership might impose legal duties as well as give legal rights, and that it may be a function of the law to protect individuals — even mature normal men — from their own weakness, as well as to ensure to the strong freedom in the exercise of their legal powers.

Modern Development.— American legislation did not become fecund until 50 years after the adoption of the Constitution, receiving its impetus from the great moral movements — anti-slavery, woman's rights and prohibition. The legal right of married women to own and dispose of property separately from their husbands was generally recognized by statutes enacted before the 19th century had passed its meridian. After the Civil War came other moral and social movements, resulting in laws for the benefit of labor and for the suppression of trusts. Peaceful strikes have ceased to be criminal conspiracies. The principals underlying the anti-trust laws are as old as the early English statutes against combinations in restraint of trade and price-fixing agreements. The law restricting woman and child labor and the minimum wage laws, however, are limitations upon the liberty of contract, and they are among the few in which the right of the state to restrict this freedom is recognized. The compensation laws transfer the burden of insuring against industrial accidents from the workingmen themselves to the industries in which they are employed. The regulation of injunctions in labor disputes gives expression to the thought somewhere entertained that judge-made law is more «aristocratic» than that made by democratic legislators. The provisions of the constitutions of North Carolina, Missouri and Oklahoma, that men have «a natural right to enjoy the fruits of their own labor,» are less broad than those of the fundamental laws of most of the States respecting the sanctity of private property. But the interdiction by the Federal Constitution of State laws impairing the obligation of contracts is a safeguard against radical departures from conventional rules — though prohibition laws and police and health regulations, confiscatory in their effect, have passed the test of constitutionality. The jurists of Continental Europe have been more receptive to advanced ideas in legislation than those of Great Britain or America. The Code Civil protects spendthrifts from their own weakness by preventing them from squandering their fortunes. Why, it is asked, should not the law also protect those who possess nothing but their physical strength from squandering all they have by making improvident bargains under compulsion of necessity? This thought lies at the bottom of a whole mass of modern social legislation. There has been a complete transformation of ideas with respect to the proposition that the state can impose no affirmative obligation upon the individual beyond the payment of taxes, — in money, in kind or in blood — nor any negative obligation except that of respecting the rights of his neighbor. It is asserted that restraint may be put on the interest of the individual in himself, or in that which he owns. No person, for instance, has the legal right to commit suicide. Property is not to be regarded as a subjective right; ownership is a «social function.» The argument runs thus: every individual is under obligation to perform a function in the community; the possessor of wealth, by reason of his possession, is enabled to accomplish certain work which others cannot accomplish; he alone can increase the general stock by putting his capital to use. For social reasons, therefore, he is under a duty to perform this work, and society will protect him only if he accomplishes it and in accord with the measure of his accomplishment. This juridical idea has found legislative expression in laws obliging owners to cultivate their land and in the taxation of unearned increment. The misuse of property, says the Swiss Code, is unlawful and one who clearly misuses his right will not be protected. Of course, the rule might be extended, beyond the misuse of ownership, to the unsocial use of anything, aptitudes or even of mere physical capacity for work. A code thus motivated would be a body of laws to enforce duties, rather than to enforce rights. Morality and legislation would have become one.

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STEPHEN PFEIL.

LAW, in science and in philosophy, a general formula expressing either a de facto uniformity of nature as we actually find it or a necessary property of all conceivable worlds. The first type is exemplified by the law of gravitation, which asserts that two particles attract one another with a force varying directly as the product of their masses and inversely as the square of the distance separating them. It is quite conceivable from the purely logical standpoint that there might be a world where the attractive force might vary as the sum of the masses of the particles concerned; observation, however, teaches us that our world is not of this sort. On the other hand, the law of contradiction, which says that no proposition can at once be true and false, is of necessity valid in any universe whatever. The distinction between the two types of laws has been minimized into one of degree by those who hold the consistency theory of truth, for these writers claim that even such laws as that of gravitation follow from the nature of any possible universe, and that their denial involves an inconsistency, or at any rate a greater degree of inconsistency than their assertion. However, from the standpoint of those who maintain the correspondence theory of truth believing that the truth of a statement depends on whether it correctly portrays a certain contingent real state of affairs, the distinction between necessary and de facto or empirical laws may well be absolute, and usually is absolute. Both necessary and empirical laws differ fundamentally from laws of right and wrong or the laws established by states. Ethical and political laws are either descriptions of things as they ought to be or schemes of procedure intended to create some desired state of affairs. Ethical and political laws may be violated without falsifying them; the violation of an ethical law is a sin; of a political law, often a crime; and many political laws contain clauses contemplating their own violation. On the other hand, to precisely the extent to which a scientific law is violated, it is not a law at all. The laws of ethics speak in the imperative; those of a natural science in the indicative. Notwithstanding the fact that, strictly speaking, a law of science is rendered invalid by a single exception, all empirical laws are either marred by exceptions or by the possibility of exceptions. Owing to the general uniformity of nature, and especially to the particular uniformities which ages of observation have disclosed to us in certain fields, when a certain conjunction of circumstances have occurred time and again, while a certain component part of that conjunction has never or but rarely been known to occur in isolation, we are able to formulate the law that the component part is an index of the presence of its associates, and to expect that whatever exceptions this law may have will be rare in proportion to the number of times it is satisfied. Further than this we can never go; the law of gravitation itself, that image of all a law of nature should be, has recently been suspected of small variations from the facts. Of *small* variations be it noted; the fact that we can make the quantitative errors of the laws of nature recede further and further is what renders a mathematical physics, and in general a precise science of any sort, at once possible and valuable. In the case of such laws as that of recapitulation in biology and of many psychological generalizations, the enormous quantitative error is concealed by a loose terminology, which is able to assume just such slight changes as to cover the facts throughout all the changes of the observations. Laws such as these are sometimes called empirical laws or generalization in a sense narrower than that in which this term has been employed in the present discussion. The justification for the larger sense of the phrase which has been employed here is that the distinction between the rawest generalization of a new science and the law of universal gravitation is simply one of degree: of the clearness of the terms employed, the measure of interrelation of the facts embraced with the other facts of the science, the amount of observation and research that has been made, and the rarity of observations contradicting the law. The law of gravitation is not *equally* fallible to the law of recapitulation in biology, but it is *similarly* fallible. For a discussion of the methods by which scientific laws are established (see INDUCTION); the discussion of induction under LOGIC.

NORBERT WIENER.

LAW, American Schools of. Among the notable features of educational progress in the United States during the 19th century, there was, possibly, none more remarkable in scope or destined to exert weightier influence upon the future of the nation than the marvelous increase in number and growth in importance of our American schools of law. That this statement is conservative rather than extravagant is demonstrated by the fact that while at the opening of that century there existed in our nation but a single professional law school — and that a private enterprise which never conferred a degree — at its close, more than 100 publicly chartered academic institutions were given official recognition as such by the national commissioner of education.

And the American school of law is to-day an institution peculiar to itself, for the reason that there existed in the mother country from which our common law and so large a proportion of our earlier statute law, as well as the formal machinery of our administration of justice, were derived, no similar scholastic organizations which could serve as models in the development of a system of instruction in jurisprudence.

Among the Continental nations of Europe, of course, and particularly among races of Latin derivation, schools of law had been firmly established from a period of remote antiquity and were held in exalted importance.

Thus, great schools of jurisprudence flourished, long prior, even to the time of Justinian, at Berytus, Rome and Constantinople, and became especial objects of the sedulous watch, care and protection of that great emperor to whose enlightened supervision the Roman law owed its systematization and codification at the hands of Tribonian and his colleagues. Although, in the earlier period of Roman history and under the republic, the youthful student who aspired to master the principles of jurisprudence usually attached himself to some lawyer of prominence from whose discourse and practice he might acquire the desired knowledge, this custom became obsolete to the degree that, under the emperors, nowhere in Rome's vast domain, outside of these three schools, of which the Sidonian was pre-eminently the most famous and successful, was professional instruction in law permitted to be given.

The impetus given by these law schools of antiquity, not alone to the study of legal principles but to the cause of learning in all branches, was incalculable. And, similarly, the renaissance of modern education has been justly held to date from the successful effort of Irnerius, at the dawn of the 12th century, to revive scholastic interest in the juridical learning of the civilians. This notable scholar and teacher, himself an alumnus of Constantinople, by the establishment, under the auspices of Frederick I of Germany and at the suggestion of Hildebrand's friend, the Countess Matilda, of his wonderfully successful lectureship on the *Corpus Juris Civilis*, provided the actual nucleus around which was eventually assembled the great university of Bologna, forerunner of all modern institutions of the kind.

But such was the history of the growth of the English common-law that slight parallelism existed between the methods by which instruction in its principles and practice could be gained by the neophyte and those open to students of legal science in Continental countries and especially among peoples whose jurisprudence was derived from or dominated by the elementary fundamentals of the Roman civil law. Thus, while elaborate and erudite courses in the history and principles of jurisprudence, ancient and modern, including both the canon and the civil law, have for centuries figured prominently in the curricula of the two great English universities, neither the highest proficiency in their scholarship nor any degree in law conferred by Oxford or Cambridge ever led to the bar in England. On the contrary, the wardship of the door to the practice of the legal profession in our mother country has ever been in the keeping of the Inns of Court, curious bodies politic which, while neither hostelries nor seminaries, partook in some respects of the nature of both, and have remained the peculiar custodians of instruction in the arcana of common-law practice and pleading.

Whether or no acceptance be accorded to the view of that eminent American jurist and legal educator, Judge Simeon E. Baldwin, that the unsystematic texture of the common law was less friendly to its pursuit as a scholastic exercise, acquiescence must be full and unreserved in his conclusion that the absence of English law schools in modern times left America no guide in this direction; and that, great as seems the present measure of her success, whatever our country has done she has done for herself, slowly, painfully, with hesitating and uncertain step.

To Tapping Reeve, lawyer, judge and legal writer of eminent distinction, belongs the honor of establishing the first American law school, at Litchfield, Conn., in 1784. Judge Reeve, a graduate of Princeton in the class of 1763, had settled in the practice of law at Litchfield as early as 1772, and had married a sister of Aaron Burr, who was an early student of law under him and an inmate of his household. Under the able guidance of its founder, who remained its sole instructor until his elevation to the judgeship of the Superior Court of Connecticut, in 1798, the Litchfield Law School speedily gained a widespread and favorable reputation. Upon his assumption of the duties of the bench, Judge Reeve associated with himself in the conduct of the school, James Gould, the well-known legal author and jurist. The Litchfield school, though, as has been said, never conferring a degree, maintained a successful career for a round half century, and during its existence numbered more than 1,000 students upon its rolls. Of its thousand alumni, some 40 rose to be justices of courts of last resort in the States of their various residences, while others reached positions of eminence as legislators in both houses of Congress. To the experience of its founder and his colleague in this pioneer school, American students and practitioners of law unquestionably owe the production of two valuable and important textbooks, each of which for more than half a century remained a standard of authority in its line. These were Judge Reeve's treatise on the 'Law of Baron and Feme; Parent and Child; Guardian and Ward' (1816), familiarly known as "Reeve on Domestic Relations"; and Judge Gould's masterly work on 'Common Law Pleading.' In passing, mention should not be omitted of the second proprietary or private law school in America which was that founded at Northampton, Mass., in 1823, by Judge Samuel Howe and Mr. E. H. Mills, a lawyer, who later became a Federal senator. The Northampton school, however, had but a brief existence of six years, and its attendance was never large.

Coming now to the question of the establishment of regular academic courses of instruction in law in publicly chartered institutions, while a professorship in English law had been established, largely through the efforts of Thomas Jefferson, in the ancient College of William and Mary in Virginia in 1782, the earliest course of collegiate law lectures ever given in America was that delivered in 1790 by Justice James Wilson of the Supreme Court of the United States, as incumbent of the chair of law in the College of Philadelphia, the institution founded by Benjamin Franklin, and merged in 1792 in the University of Pennsylvania. Auspicious circumstances attended this opening of American collegiate instruction in law, the lecturer being not only one of the best read and most deeply learned lawyers of his time, but, by reason of his distinguished record as a signer of the Declaration of Independence, and a member of the Constitutional Convention of 1787, a van-leader of public thought and action. In deference, we may suppose, to his high dignity as a member of the Federal judiciary, his introductory lecture on 15 Dec. 1790, was attended by a brilliant concourse of public officials, including the President of the United States and his Cabinet, as well as the governor of Pennsylvania, members of Congress and of the State legislature. But the course, or rather series, for Judge Wilson delivered three courses of lectures during that academic year, ended with its close; and no further instruction in the subject was attempted in the University of Pennsylvania until 1817, when law lectures were once more given during the period of a single year; following which came another interval of total inactivity in that institution lasting until 1850.

In New York, the history of academic legal instruction began with the appointment of James Kent, in 1793, to a professorship of law in Columbia College, his first course of lectures being delivered to a small class, during the following year, and succeeding courses in 1795 and 1797. Owing to the slight attendance, however, he resigned the chair in 1798, upon his accession to the bench of the Supreme Court of New York, of which he became chief justice in 1804. In 1823, at the age of 60, having served in the previous year as a member of the convention to revise the State constitution, and having been chancellor of New York since 1814, he retired from the bench and was reelected to his former chair at Columbia. The incalculably valuable service which he had rendered to the cause of American jurisprudence and especially to the administration, development and extension of equitable jurisdiction, he now supplemented by elaborating his learned and lucid lectures into those incomparable commentaries on American law in four volumes (1826–30), which for more than three-quarters of a century have remained for the lawyers of our country as solid and standard an authority of reference as were the works of Coke and Blackstone to English practitioners. Attendance upon the chancellor's lectures appears, however, to have been perfectly vountary with the student body, no regular law course being prescribed, no examinations on the subject being held and no degrees in law conferred. In point of fact, no department of law appears to have been regularly organized at Columbia until 1858; and it seems that prior thereto no law school existed in New York city.

Eldest of existing American law schools organized as such is the Harvard Law School, which was established in 1817. While it is true that as early as 1779 Isaac Royall, a Massachusetts citizen, then resident in London, had bequeathed property to Harvard College for the establishment of a chair of law, the fund did not become available until 1815, and the duties of the incumbent, up to the time of the appointment of Hon. Asahel Stearns as university professor of law in 1817, consisted merely in the delivery of 15 lectures annually to the senior class in the college. Professor Stearns remained 12 years at the head of the law school, and it may justly be said with every desire to render due credit to this distinguished and faithful instructor that they were years of small beginnings and of little advancement for the institution. The Litchfield school enjoyed such a high repute that it easily attracted a far larger and more enthusiastic attendance, while even the Northampton school was a dangerous rival. In 1829, however, a new phase was placed upon the condition and prospects of the Harvard Law School by Hon. Nathan Dane's generous donation of $10,000 for the endowment of a new professorship of law, coupled with his request that Mr. Justice Story of the United States Supreme Court, Marshall's great coadjutor and the only one of his associates who fairly divides with him the fame of the early administration of that mighty bench, be appointed the first Dane professor.

Simultaneously, John Hooker Ashmun, then head preceptor of the Northampton school, was tendered the chair of the Royall professorship. The average of attendance at the Cambridge school had then sunk to that of a single student, but upon the acceptance of its headship by Judge Story a revival of interest was manifested and the close of his first year's administration saw in the neighborhood of 30 pupils enrolled. The Northampton school immediately ceased to exist and the Litchfield school was abandoned four years later. Professor Ashmun's death in 1833 was followed by the election, as Judge Story's colleague, of Simon Greenleaf, an advocate of eminence, the first official reporter of the decisions of the Supreme Judicial Court of the State of Maine, and the distinguished author of that treatise on the law of evidence, which at once became, as it has since remained, a standard of authority in all countries ruled by English law.

The Yale Law School is second in age only to that of Harvard, and, while ordinarily spoken of as established in 1824, practically dates from the appointment in 1826 of Hon. David Daggett, a judge of the Superior Court of Connecticut, to the professorship of law in the college — a chair which had been established, indeed, as early as 1801, under the presidency of Rev. Dr. Timothy Dwight, and had been previously administered by the Hon. Elizur Goodrich, but merely as a lectureship on the leading principles of legal science with no view to qualifying students for the bar. Professor Daggett, however, had been, up to the time of his appointment, associated with a leading advocate, Samuel J. Hitchcock, in the conduct of a private law school in New Haven, and, under his supervision, the Yale department of law speedily took shape as a practical law school.

In 1833, graduates of the Litchfield school established a law school at Cincinnati, and similar schools were founded at Louisville, Ky., in 1846 and at Lebanon, Tenn., in 1847. The number of American law schools prior to 1850 was thus extremely limited and the aggregate attendance upon their courses was correspondingly small.

Twenty years later, in 1870, the number of law schools had increased to 28, with an aggregate attendance of 1,653 students. In 1880 there were 48 schools, serving 3,134 students; in 1890, 54 schools with 4,518 attendants, and in 1901 the number of schools had reached 100, with more than 13,000 pupils enrolled. The report of the United States Commissioner of Education for 1910 gives statistics of attendance at 114 law schools of a total student body numbering 19,567, of whom 205 were women. The distribution of these schools among the various States was as follows: One each in Alabama, Arkansas, Connecticut, Idaho, Maine, New Jersey, North Dakota, Oklahoma, South Dakota, Texas, Utah, Washington and West Virginia; two each in Colorado, Florida, Iowa, Kansas, Louisiana, Michigan, Minnesota, Mississippi, Oregon and Wisconsin; three each in Georgia, Maryland, Massachusetts, Nebraska and Virginia; four each in California, Pennsylvania and North Carolina; five each in Kentucky and Tennessee; six each in the District of Columbia, Indiana and Missouri; seven in Ohio and nine each in Illinois and New York. The significance of this vast and rapid growth may perhaps be more readily grasped when one remembers that from 1875 to 1899 the number of students enrolled in professional schools in the United States increased as follows: In theology, 58 per cent; in medicine, 177 per cent; in law, 343 per cent.

In 1910 there were 184 American schools of theology, with an attendance of 11,012 students, an increase of 3,000 students over the number of students in 1900, while the number of students in the 114 law schools rose from 12,516 in 1900 to 19,567 in 1910.

At 55 law schools the course essential to graduation covers three years; at 38 a two-years' course leads to a bachelor's degree, while five institutions in the Southern States have only a one-year course. Under the influence of the section on legal education of the American Bar Association, a constant and gratifying advance in the standard of instruction and in the lengthening of the course for the bachelor's degree in American law schools is to be noted. In 1890, only eight schools required three years' attendance for the bachelor's degree, while eight years later progress in this direction had been so great that no less an authority than Joseph H. Choate, in the annual address delivered before the American Bar Association, did not hesitate to declare, «The standard of legal education has never before been advanced to its present height. The young men who come annually from the law schools to recruit our ranks, are better equipped and qualified — far more so, than we ever were — to enter upon the arduous and responsible duties that await them.»

The marked elevation in the requirements for admission to American schools of law is shown by the fact that while, prior to 1877, no entrance examinations were prescribed in any of them, and so late as 1890 there was but a single institution demanding a demonstration of precedent educational attainments equivalent to the requirements for college matriculation, nearly one-half of the recognized law schools of this country now deny admission to applicants except upon terms that would practically secure their entrance to the average college of liberal arts. The highest standard of admission is that prescribed by Harvard, which for some years past has refused to admit, as candidates for degrees of law, students not holding the degree of bachelor of arts, conferred by some college of recognized standing. In this position the Cambridge authorities have been followed, not without great hesitation and well-founded reluctance, by Columbia. The strongest objection to such a requirement may be summed up in the statement that, there being no necessary correlation between the courses of study pursued by various students in different institutions leading up to the academic degree, its possession is not strong evidence of any special equipment for the pursuit of legal studies; and that the object aimed at might be better and more directly attained by the establishment of entrance examinations at the various schools of law sufficiently comprehensive in scope and exhaustive in character to establish the applicant's fitness to enter intelligently upon the study of the principles of law. Ninety-seven schools, with an enrolment of 8,464 students, constituting the Association of American Law Schools, have united in the uniform requirement that each school belonging to the association shall maintain an entrance examination equivalent to that required for graduation from a high school.

It is a matter of singular interest that with the steadily advancing standard of entrance requirements, there has followed an almost equivalent decline in the importance of a diploma of graduation from a law school as a factor in securing admission to the bar. Formerly, in many jurisdictions, such a diploma was by statute an immediate passport to the practice of the profession, but with the stiffening of the educational requirements demanded of the law student there has most fortunately concurred a quickening of the conscience of the courts as to their duties and responsibilities in the premises; with the result that the sound judgment of lawyers and legal educators has been gradually led to endorse the proposition that it is neither logical nor desirable for schools of law in no way subject to the supervision of the courts to possess the unrestricted power to create officers thereof. The influence of the American Bar Association and its junior organization, the Association of American Law Schools, has for some years been steadily and wisely directed to securing the abolition of the exercise by law schools of this power, which should properly be exercisable only by the courts. While there can be no doubt of the eventual establishment of this reform universally, a law school diploma still admits to the bar in the States of Alabama, Georgia, Kansas, Louisiana, Michigan, Mississippi, Missouri, Pennsylvania, South Carolina, Tennessee, Texas, West Virginia and Wisconsin.

In many of the States this matter has now been wisely regulated by placing the matter of admission to the practice of law exclusively within the jurisdiction of State boards of law examiners, the members of such boards being usually appointed in rotation for fixed terms by the justices of the highest appellate courts of the respective States.

As the American school of law was practically compelled to construct its own road to success, it is not unnatural that there should have arisen considerable divergence of opinion and of practice in the matter of methods of instruction. Roughly, it may be said that three systems have prevailed; a system of instruction by lectures and dictation; a system of instruction by the study of and recitation from prescribed textbooks of authority; and a system of instruction confined largely to the reading and expounding of selected cases of leading importance, indicated by the instructor, through which the student is encouraged to delve for a mastery of the principles involved. The latter method, first generally introduced on a scientific basis by Prof. C. C. Langdell, Dane professor of law at Harvard, and since greatly elaborated by his colleagues, Profs. James Barr Ames, Joseph H. Beale, Jr., and Samuel R. Williston, as well as by Prof. W. A. Keener, of Columbia, and Prof. Ernest Huffcut, of Cornell, may be justly considered the prevailing system in our law schools of to-day, although justice requires the statement that none of these methods is or ever has been exclusive of the others, but rather that the curriculum of every well-directed law school in the present, as in the past, has ever included a greater or less proportion of attention to each of these systems.

No review of the history of American law schools would be just or complete which failed to note the remarkable debt under which the practice and the administration of law in this country has been placed by the contributions to legal literature made by members of their various faculties in the form of standard textbooks, usually, if not universally, the outgrowth of carefully prepared courses of lectures primarily designed solely for the guidance of their student bodies. Reeve's on 'Domestic Relations,' Gould on 'Pleading' and Kent's 'Commentaries on American Law' have already been instanced. Story's treatises on the 'Elements of Constitutional Law' and on 'Equity Jurisprudence'; Greenleaf's exhaustive summarization of the law of evidence and Parsons' great work on the 'Law of Contracts' constitute three monuments of this sort which alone would reflect imperishable renown on the Harvard Law School could it point to no other ground of claim to its present distinction. And an interesting parallelism subsists between the facts that, as it was the donation to Oxford by Viner of the profits of his compendious abridgment of English law which furnished the foundation of the Vinerian professorship, the first and greatest fruit of which was the elaboration by Sir William Blackstone of his course of lectures into the imperishable 'Commentaries on the Law of England,' so it was the donation to Harvard by Dane of the profits of his later abridgment of law which directly stimulated the production of Joseph Story's masterly work on 'Equity Jurisprudence.'

Other notable instances of legal authorship in point are the great work on 'Constitutional Limitations,' by Judge Cooley of the law school of the University of Michigan, the elaborate and finished analysis of private international law by Prof. Raleigh C. Minor of the University of Virginia, and the learned exposition of the 'Law of Estoppel' by Melville M. Bigelow, of the 'Law of Wills and Administration,' by James Schouler, and of the 'Law of Wills,' by George Enos Gardner, of Boston University.

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LAW, Canon. See Canon Law for history previous to the new Code.

LAW, Canon, The New Code of. That the Catholic Church, as a perfect society, enjoys the right of directing her members by positive laws in the attainment of her end, the sanctification and salvation of souls, no one will deny. Early Christians, strong in their belief and diligent in the observance of divine precepts, were guided chiefly by apostolic men and by the Sacred Scriptures. Increasing in number, spreading over the world and growing less fervent in religious practices, Christians were of necessity subjected more and more to positive regulations. Various laws to meet various conditions of time and place were enacted, for while the Church is immutable in her doctrine, her discipline is necessarily subject to change. Indeed of the many ecclesiastical laws promulgated throughout the centuries, not a few had been abrogated by the supreme authority of the Church, some had become obsolete, while others, owing to changed conditions, were found to be difficult of execution or less useful and expedient for the common good. Because too of their number and the fact that they were not easily accessible, Pius X, soon after his election as Pope, 4 Aug. 1903, realizing how helpful it would be for the stable restoration of ecclesiastical discipline to put an end to these inconveniences resolved to arrange in a clear and orderly collection all the laws of the Church that had appeared adown the ages, abolishing those that had become obsolete, adapting others to present needs, and enacting new ones as necessity or expediency might suggest. The first steps were taken in March 1904, a commission, as it is called, of cardinals being put in charge of the project under the leadership of Cardinal Gasparri, while canonists of note from various countries were asked to aid by their counsel and labors. The work when nearing completion was submitted to the bishops of the world, whose suggestions had been sought in the beginning, as well as to the superiors of religious orders, for a final expression of opinion on the prepared canons. Meanwhile Pius X had been succeeded in the chair of Peter by Pope Benedict XV, to whom it fell to give to the world on Pentecost, 27 May 1917, the completed code, over 13 years after the inception of the task. The prescriptions of the new code, however, did not become effective till the following Pentecost, 19 May 1918. The bull of promulgation, which is styled, as is the custom, from the first words Providentissima Mater Ecclesia — Most Provident Mother Church, is addressed: To our venerable brethren and beloved sons, the patriarchs, primates, archbishops, bishops and other ordinaries, and also to professors and students of Catholic universities and seminaries. The code, as might be expected, is in Latin, the language of the Church. To translate it into another tongue or to reprint the original Latin text permission of the Holy See is required.

Introduction.—A lengthy preface to the code, written by Cardinal Gasparri, enters extensively into the history of canon or ecclesiastical law and its compilations, giving especially the particulars of the present codification. Then come the constitution providentissima and a decree (15 Sept. 1917) of Benedict XV, by which a commission of cardinals and counsellors is instituted to interpret the new code. This constitution moreover reminds the Roman congregations that their office is to enforce the law and forbids them to issue new regulations of general character, except the need be apparent. Such new legislation, if contrary to the code, must have the approval of the Pope. The commission will see also that insertions or additions to the code are put in the proper place and all discrepancies removed. Thus it is hoped to keep the code ever complete and consonant with actual circumstances or needs. These constitutions are followed by a profession of faith, in the usual form, which is obligatory at certain specified times for certain clerics, as for example in synods or on promotion to a parish. This formula then will be at hand when required.

Contents and Divisions.— The code, comprising 2,414 canons, is divided into five books. The first book contains certain preliminaries and general notions concerning laws, customs, rescripts, privileges, dispensations and the method of computing periods of time as applicable in canon law. The other books treat respectively of persons, things, processes, crimes and punishments. We note the following: Future laws, emanating from the Holy See, will not bind, unless otherwise stated, until three months after their promulgation in the official periodical, *Acta Apostolicæ Sedis*. Laws, however, that are merely confirmatory of natural or positive divine law are of immediate obligation. Bishops or other legislators inferior to the Holy See are free to adopt any adequate method of making known their laws, and may insist on immediate observance of them. Laws are assumed to be territorial, not personal, unless there is evidence to the contrary. Disciplinary laws, not found in the code, are abrogated; liturgical norms on the contrary remain in force. Merely prohibitive laws must be clearly distinguished from those that render an act null. Subjection to local laws, with certain exceptions, is determined by domicile, namely, by dwelling in a place with the intention of remaining there. A domicile is usually parochial, though a person may possess a domicile in a diocese and not in a particular parish. One who is unbaptized, or, if baptized, has not attained the use of reason or is mentally irresponsible, is not subject to ecclesiastical laws. Those who are under 21 years of age are minors, beyond that majors; an idea that has its bearing in the application of certain laws. Dioceses are divided territorially into parishes, while in countries where dioceses do not exist, but vicariates and prefectures apostolic, these divisions are styled missions or quais-parishes. The priest who is in charge of a parish is a pastor, while a rector administers a mission. Parishes are determined by territorial lines, not by languages or nationalities, though where these latter exist they are to remain.

By virtue of the constitution sapiente consilio the Roman congregations, tribunals and offices were remodeled under Pius X. Some further changes are noted in the code. The Holy Office assumes the work of the congregation of the index; a separate congregation for Oriental affairs is established while the congregation of seminaries and universities appears with its new title. The privileges of cardinals are mentioned in detail. Bishops for the most part are selected directly by the Holy See, must be at least 30 years of age and possess the qualities demanded by the office. A diocesan bishop is obliged to pay an official or canonical visit to the various parishes and institutions of his territory at least every five years, while all are required at prescribed times, varying from 3 to 10 years according to the distance from Rome, to report personally to the Holy See. The bishops of America are called on also for a written report every five years. A diocesan bishop is assisted by a vicar-general, who has jurisdiction throughout the diocese, and various others who constitute the episcopal *curia* or official family of the bishop. An official, distinct from the vicar-general if the volume of work involved require it, has charge of juridical matters. Deans or vicars forane enjoy minor delegated powers, each within his own section of the diocese. A bishop has his advisory board. In some countries the cathedral chapter fills this office, but in America the diocesan counsellors are priests, usually six in number, selected by the bishop for a term of three years from the clergy of the episcopal city or vicinity. All matters relating to them are determined in the code. Appointments to ecclesiastical offices should be in writing.

Pastors.— It is the mind of the Church that a pastor's tenure of office, as far as the good of religion will permit, should be permanent. In the United States some are permanent, others not. Bishops, however, may with the advice of the cathedral chapter or council, grant permanent pastors to all parishes. Parishes that may be erected in the future will have permanent pastors, unless the bishop in consultation with his advisory board decide otherwise. A concursus or competitive examination, where formerly prescribed for promotion to a pastorate, still remains in force. A non-competitive examination is required for appointment in other cases. All pastors, even though they belong to the permanent class, may be removed, transferred or demoted for reasons assigned in law. Unbecoming conduct, physical or mental unfitness, the peculiar qualities of the pastor which the bishop wishes to employ elsewhere, and other causes are found among the legal reasons for removal. In all cases where the authorities proceed without the consent of the pastor in question certain formalities must be observed, and when a criminal charge is alleged as the reason for action, formal judicial proceedings are required.

Pastoral duties and rights remain practically as they were in previous legislation, though our former rectors are now pastors with parochial rights, obligations and privileges *by reason of their office*. They may now grant absolution from sin in the sacrament of penance under the usual conditions, to the members of their parish, not merely within the limits of their diocese, but anywhere throughout the world. They have the obligation, binding in strict justice, of applying the Holy Sacrifice of the Mass for their parishioners on all Sundays, and some other specified days during the year. The administration of the sacraments of baptism and extreme unction, and assisting at the marriage and burial of parishioners, are parochial rights reserved to pastors ordinarily. The chief duties incumbent on pastors are to reside in the parish, preach, instruct, visit the sick and to administer in every way to the spiritual welfare of their people. The administration of the temporal goods of the parish is a most important duty in some countries. The number, appointment and removal of associate pastors or assistant priests belongs to the bishop of the diocese.

Clerics and Religious.— The clerical state is embraced in the reception of tonsure. Every cleric must be attached to a diocese or to a religious community. A bishop may promote to the priesthood or other orders his own subjects only. In this respect one becomes subject to a bishop either by reason of his birth and domicile in the diocese, or by acquiring a domicile in the diocese. For legitimate reasons a cleric, if he desire, may be transferred from one diocese to another with the approval of both bishops. The transfer, with a few exceptions, must be made in writing.

A novitiate or period of probation of at least one year is necessary for admission to the religious state. Then follow vows of poverty, chastity and obedience for three years, after which perpetual vows may be made, if agreeable to superiors. Some religious are likewise clerics. The profession of perpetual vows in a religious society releases a cleric from his diocese. Should he later for any reason whatever be dispensed from his vows or become secularized, he must find a bishop who is willing to accept him. A cleric who has not made perpetual vows in religion reverts, on leaving his community, to the diocese to which he was canonically attached.

The Sacraments.—As far as possible the sacraments are to be conferred in a church, not in private houses. The ordinary minister of the sacraments of confirmation and orders is a bishop; of the other sacraments, a priest. As baptism is necessary for salvation, infants receive this sacrament. At least one sponsor, if possible, is required in baptism, while more than two, one of each sex, are not allowed. A sponsor, as a rule, should have reached the age of 14. To act in this capacity clerics in major orders require their bishop's permission, while religious are excluded except in case of necessity, and then too permission of the proper superior is necessary. Only the spiritual relationship which is contracted in baptism constitutes at present a nullifying matrimonial impediment, and merely between the one baptized and the sponsors; a modification of previous discipline. Confirmation is not to be administered ordinarily to children under seven years of age. A sponsor is required and one only is permitted. The same sponsor acts for one or at most for two, though the prelate confirming may for sufficient reason determine otherwise. As a rule the same sponsor should not act for the same person both in baptism and confirmation.

Not every priest, merely by reason of his ordination, is qualified to hear sacramental confessions. To pronounce sentence in the tribunal of penance he needs jurisdiction. This a bishop grants for his own diocese. A special authorization is required to hear the confessions of religious or novices in their own houses.

Any priest not inhibited may offer the Holy Sacrifice of the Mass once each day, twice in case of necessity on Sundays or other days on which the faithful are obliged to hear Mass, three times on Christmas and All Souls Day (2 November). Mass and the distribution of Holy Communion are allowed from one hour before the aurora till one hour after midday. An exception to this regulation permits Mass at midnight on Christmas eve with certain restrictions. No matter how late the hour the celebrant must be fasting from midnight. On Good Friday the Mass of the presanctified, without consecration, is offered and the Blessed Eucharist is not distributed to the people. The sick at times, under well-defined conditions, are permitted to receive Holy Communion when not fasting. All who have attained the use of reason are obliged to receive Holy Communion at Easter time. In some countries only two weeks, from the Sunday before till the Sunday after Easter, are allowed for fulfilling this precept. Bishops may, however, extend the period from the fourth Sunday of Lent — and in the United States from the first Sunday of Lent — to Trinity Sunday. Frequent, even daily, communion is recommended.

In Extreme Unction, the anointing of the feet may be omitted for any reasonable cause. The anointing of one sense, preferably of the forehead, with a briefer verbal form too than usual, will suffice, when death appears imminent. The usual prayers and unctions are supplied later, should death be delayed. This sacrament is administered conditionally, when it is doubtful whether the person is actually sick unto death, or is still alive, or has attained the use of reason.

At least the theological course of candidates for the priesthood should be spent in a seminary. The age prescribed for the various orders remains as before, except that tonsure may not be given before the candidate has commenced the study of theology, subdeaconship not earlier than toward the end of the third year of theology, deaconship at the beginning and priesthood after the middle of the fourth. The space that should intervene between the orders is practically left to the judgment of the bishop. Nevertheless the reception of tonsure and a minor order, or all four minor orders, or the last minor order and subdeaconship, or two major orders on the same day is forbidden. While the Saturdays of the ember weeks, the Saturday before Passion Sunday and the Saturday of Holy Week are the usual ordination days, tonsure may be given on any day, minor orders on Sundays and feast days that are doubles (a liturgical term), major orders on Sundays and holydays. All privileges contrary to these prescriptions have been withdrawn. Irregularities, which are certain canonical hindrances either to the reception or to the exercise of orders, have undergone some modifications. The law is precise in demanding testimonial letters, examinations and spiritual exercises in preparation for orders. Announcement too is made in one's parish that he is about to receive a major order.

Espousals, to have any effect, must be in writing and properly witnessed. The marriage of a Catholic is not recognized unless it take place in the presence of a pastor or ordinary (bishop, vicar-general or administrator) within his own territory or before a priest duly delegated by one of these, and two witnesses. Some exceptions are made to the general rule when one of the contracting parties is in danger of death, and in other cases when it is foreseen that a duly authorized priest cannot be approached within a month. The age of lawful consent for marriage is 16 for the male, 14 for the female. A Catholic contracts marriage invalidly with an unbaptized person, illicitly with a baptized non-Catholic, without proper dispensation. Until the code became effective a marriage between a baptized and unbaptized person was always null. At present disparity of worship, as this impediment is called, nullifies a marriage only when one of the parties has been baptized in the Catholic Church or has been received into the Church. Affinity, which arises from a valid matrimonial contract, constitutes a diriment impediment, indefinitely in the direct line, inclusive of the second degree in the indirect. Public decency or fitness, an impediment which has its origin in an invalid marriage or in public or notorious concubinage, does not extend beyond the second degree and then in the direct line only. The impediment of consanguinity, which formerly embraced the fourth degree in the collateral line, now ceases at the third; thus second cousins are within the prohibited degree: in the direct line marriage is never tolerated. The reception of subdeaconship, as well as a solemn religious profession, begets a diriment impediment. The forcible retention, as well as abduction, of a woman with a view to marriage, renders her incapable of a lawful matrimonial consent, while still in duress. Fear or force may be sufficient to invalidate matrimonial consent. The Church may for sufficient reasons dispense in matrimonial impediments which she herself originated, not in those which are founded on the natural or divine law.

Holydays and Fasting.— Catholics on holydays are bound to abstain from servile work and to assist at Mass. The feasts of Christmas, Circumcision, Epiphany, Ascension, Corpus Christi, Immaculate Conception, Assumption, Saint Joseph, Saints Peter and Paul and All Saints are holydays, except where, with permission of the Holy See, they have been abrogated. Thus in the United States the feasts of Epiphany, Corpus Christi, Saint Joseph and Saints Peter and Paul are not observed as holydays.

The law of abstinence forbids the eating of flesh meat, while the law of fasting allows only one full meal a day with a small amount morning and evening. The prohibition of partaking of meat and fish at the same meal on certain days no longer obtains. The law both of abstinence and fasting ceases on Sundays or holydays, except on holydays during Lent. Abstinence alone is obligatory on all Fridays. The law of abstinence together with fasting is binding on Ash-Wednesday, the Fridays and Saturdays of Lent, Ember Days, and on the vigils of Pentecost, Assumption, All Saints and Christmas. On all other days of Lent fasting alone is incumbent on Catholics. Both laws cease at noon on Holy Saturday. All who have reached the age of seven years are subject to the laws of abstinence, while the regulations concerning fasting affect those who are between 21 and 60, unless they are excused through infirmity, hard labor or other legitimate reason.

Records and Examinations.— The Church is solicitous concerning her records of baptisms, confirmations, marriages, orders, funerals and interments, financial matters and administration of property, spiritual status of parishioners, etc. Many minute details in regard to all these matters are now prescribed.

An examination is the usual method prescribed for determining one's fitness for receiving orders, preaching, hearing sacramental confessions, accepting a pastorate. An annual examination for at least three years after promotion to the priesthood is prescribed for the diocesan clergy, as well as conferences, essays, papers and the like at stated times on theological subjects.

Delicts, Processes and Punishments.— Crimes against faith, religion, ecclesiastical authority, violations of the rights of others, maladministration of ecclesiastical goods, abuse of authority, neglect of one's duties, these and similar matters have their place in the code, with the process, judicial or extrajudicial, as the case may require, to be observed in establishing guilt and inflicting punishment. Prescriptions regarding the personnel of courts and other matters are many and varied. The penalty to be inflicted in punishment of delicts or violation of law is often stated specifically in the code, sometimes it is left, within certain restrictions, to the presiding judge. Ecclesiastical penalties for the most part are spiritual, the most severe of all being excommunication, suspension and interdict, which are included under the general term of censure. Admonitions, corrections, penances, loss of emoluments, pecuniary fines, denial of promotion are among the less rigorous canonical punishments. Processes that are not of a criminal character are likewise noted in the code, such as civil suits, processes to determine the invalidity of a matrimonial contract, of orders received, or of a religious profession, as well as various others that are extrajudicial.

Conclusion.— Some constitutions that are not new, and which relate to the Holy See while vacant, the regulations governing the conclave in which the new Pope is elected and other matters during the interregnum, are given in the code. A most satisfactory alphabetical index of its contents completes the volume.

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LAW, Civil. See CIVIL LAW.

LAW, Commercial. See COMMERCIAL LAW.

LAW, Common. See COMMON LAW.

LAW, Constitutional, that part of public law which regulates the political organization of a State and so named because usually embodied in a written instrument called a constitution. It is sometimes spoken of as the organic or fundamental law of the State because it is the basis of all other municipal law. It differs from international law in being wholly municipal in character and from administrative law in that it regulates only in a general way the organization of the government, leaving the details to be regulated by the rules of administrative law. It differs from ordinary statute law both as to its source and method of enactment and as to its content. While statute law is enacted, modified and repealed by the legislature, constitutional law is usually enacted by a constituent convention especially chosen for the purpose while its validity is, in America at least, usually made to depend upon the approval of the electorate, to whom it is submitted by way of referendum. Hence it is commonly said that constitutional law is enacted by the people, whereas statute law is the work of their representatives. This distinction as to method of enactment, however, is not universal. In some States the same bodies which enact ordinary statute law also ordain and alter the body of constitutional law.

This is true in Great Britain, where the Parliament may alter the constitution in the same manner in which it may enact or repeal an ordinary statute. Likewise in France and in Germany the Parliaments may make amendments to the constitution subject only to the limitation that the French Chambers are required to observe certain formalities which they do not observe in passing ordinary statutes, and in Germany an extraordinary majority is required. In Switzerland the people participate directly in the enactment of their constitutional law, not only through the referendum (q.v.) but also through the so-called initiative by which they are empowered to draw up proposed constitutional amendments and submit them directly to the electorate for approval. For the different types of constitutions see the article CONSTITUTION.

The distinction between the content of constitutional law and that of ordinary statutory legislation is largely one of degree and in the States of the American Union this distinction is fast disappearing. Among the proper subjects of constitutional law are (1) the structure and powers of the government including a distribution of its legislative, executive and judicial functions, among separate and distinct organs; (2) a definition of the class empowered to participate in the choice of elective officers and the method by which that choice is to be exercised; (3) the determination of the qualifications, duties and privileges of those empowered to hold government offices and mandates; (4) the creation of a sphere of individual liberty — usually embodied in a bill of rights — upon which the government is forbidden to encroach, and (5) provision for a legal and orderly method of making changes in the constitution so as to avoid the risks and dangers of revolution. In addition to these subjects which may be denominated the essentials of a constitution scientifically drawn, it is common to incorporate therein various provisions relating to education, patents, copyrights, the army and the navy, the militia, corporations, public debts, rules of judicial procedure, regulations concerning official salaries, taxation and administration, etc., which according to strictly juristic tests are more properly subjects for statutory regulation. The effect of this practice has been to introduce into the domain of constitutional law a considerable amount of private law, thus derogating from the principle that the constitution should be exclusively an instrument of public law. On the other hand the usual difficulty of amending the constitution so as to adapt it to new conditions and exigencies has made it necessary to deal with certain subjects by statutory legislation, although they are properly matters that should come within the province of constitutional law. Notable instances are statutes for the government of dependencies. Thus the ordinance of the old Confederate Congress of the United States, passed in 1787, for the government of the Northwest Territory, the various statutes for the organization of the other Territories of the United States, the acts for the government of the Philippine Islands and Porto Rico were of the nature of constitutions of government for the dependencies to which they applied. They were mainly instruments of constitutional public law, although cast in the form of statutes.

A final distinction between constitutional law and statute law is the element of paramountcy which belongs to the former. In all countries where constitutional law is a separate and distinct body of jurisprudence its prescriptions take precedence over all statutory enactments in case of a conflict between the two. In such cases the conflicting statute is said to be «unconstitutional» and is treated as invalid. The power of determining the fact of irreconcilability has been assumed by the judicial branch of the government in the United States and has been so long acquiesced in that the power will probably never be questioned, although it is not expressly conferred by the Constitution. In none of the continental European countries have the judiciaries assumed such power, and in England the «constitutionality» of an act of Parliament can scarcely arise, since that body is legally omnipotent. The rules for the construction of the prescriptions of constitutional law are essentially the same as those for the construction of statutes except that constitutions are more strictly interpreted and constitutional commands are more often construed as mandatory where similar provisions in statutes would be treated as directory only.

In the United States, and in fact in all countries having the federal form of government, there are two bodies of constitutional law, namely, that which is national in scope and that which is local, the former being paramount to the latter in case of conflict. In the United States that part which is federal or national consists of the Constitution «established and ordained by the people» in 1788, including the subsequent amendments thereto, together with the interpretations of the Federal judiciary and the usages and customs which have grown up in connection with the administration of the government. Among the important principles which have been developed as a result of judicial interpretation may be mentioned the right of the government to acquire and administer foreign territory, the immunity of the national government, its instrumentalities and agencies from taxation by the States, the right of the government to issue legal tender paper currency both in time of war and in time of peace, the exclusive power of Congress over foreign and interstate commerce, the exclusive power of the States over all matters relating to the suffrage subject to the limitations of the 14th and 15th amendments, the right of the national government to undertake internal improvements, the right of the courts to declare laws unconstitutional, the right of Congress to abrogate a treaty, etc. Among the usages which have become for all practical purposes a part of Federal constitutional law may be mentioned: the ineligibility of the President for a third term, the obligation of presidential electors to vote for the party nominees, the power of the President to remove his appointees without the consent of the Senate, the method of legislation by the committee system, the requirement that representatives in Congress shall reside in the districts from which they are chosen, etc.

Likewise the constitutional law of the individual States is embodied in written constitutions, in most cases prepared by constituent assemblies and approved by the electorate upon referendum, together with the amendments thereto and the interpretations of the State judiciaries. Several of the early State constitutions were prepared and put into effect by the legislatures or by irregular revolutionary assemblies without popular ratification.

With one exception (Delaware), no alteration can be made in any of the existing constitutions without the approval of the people at the polls, and but three of the constitutions now in force were put into effect without ratification by the electorate. The earlier constitutions were brief instruments containing but little more than the law for the organization of the government and the necessary safeguards for the protection of individual liberty, but the later ones are bulky documents containing a vast amount of private law relating to matters which are properly subjects of statutory regulation. This increasing tendency to amplification has resulted from the popular distrust of the State legislatures and the consequent desire to place the regulation of many matters beyond the power of the legislature to alter or repeal it. The effect has been to destroy in a large degree the scientific distinction between constitutional law and statutory law, to retard the constitutional development of the commonwealth, and to add confusion to the task of the student and the practical constitutional lawyer.

In Great Britain the existing body of constitutional law differs in several respects from that of the United States. In the first place it is not so much the result of revolution nor is it so nearly the finished product of a constituent assembly. It is more the product of evolution and growth and is more largely unwritten than that of the United States. Moreover, what is written is scattered through different acts instead of being contained in a single compact instrument. Finally, the Parliament being the chief source of constitutional as well as of statutory law there are no juristic tests upon which a distinction may be founded — a fact which has led Mr. A. V. Dicey, one of the most learned English commentators, to declare that the constitutional law of England is a «sort of maze in which the wanderer is perplexed by unreality.» He questions whether English constitutional law is really law, and expresses the opinion that it is only a cross between history and custom, undeserving of the name of law. As the term is used in England, he says, it includes all rules which define the members of the sovereign power and regulate their relations to each other, which determine the mode in which the sovereign power is exercised, which prescribe the order of succession to the throne, which regulate the prerogatives of the chief magistrate, determine the form of the legislature, define the territory of the state, etc. Such of these rules as are enforced by the courts he calls collectively the «law of the constitution.» The others which consist of understandings, habits or practices, and which are not enforced by the courts, he calls the «conventions of the constitution,» or constitutional morality. To the former class belong the rule as to the irresponsibility of the king and the responsibility of his ministers; to the latter belong the rules relating to the executive veto, the initiation of revenue bills and the resignation of ministers. Monsieur Boutmy, a learned French commentator on the British Constitution, points out that the principal sources of the constitutional law of England are: (1) Treaties or quasi-treaties, such as the Acts of Union; (2) the common law; (3) solemn agreements, for example, the Bill of Rights; (4) statutes. Of the other European countries the constitutional law (*Staatsrecht*) of Germany is most nearly like that of the United States as to its source, content and dual character. The constitutional law of the French Republic may be dismissed within a sentence. It is embodied in a brief instrument of a few hundred words, contains a bare outline of the organization of the government, does not contain a solitary provision in behalf of individual liberty, and any part or the whole may be altered by the legislature at will.

Bibliography.—Anson, 'Law and Custom of the Constitution'; Burgess, 'Political Science and Constitutional Law'; Boutmy, 'Studies in Constitutional Law'; Cooley, 'Principles of Constitutional Law'; Dicey, 'The Law of the Constitution'; Story, 'Commentaries on the Constitution'; Lebon, 'Das Staatsrecht der französischen Republic'; Laband, 'Das Staatsrecht des deutschen Reiches'; Willoughby, 'On the Constitution.'

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LAW, Criminal. See CRIMINAL LAW.

LAW, Customary. See CUSTOMARY LAW.

LAW, International. See INTERNATIONAL LAW.

LAW, Maritime. See MARITIME LAW.

LAW, Military, a term, which, in its more restricted sense, describes the legal system that regulates the organization and government of the military establishment of a state and the discipline of its armed forces. It applies to the conduct of civilians in a very limited number of cases. Even military persons are, ordinarily and in time of peace, amenable to military law for military offenses only — for instance, desertion, mutiny, insubordination, neglect of duty, unbecoming conduct, frauds upon the government, etc. Though officers and men may be further disciplined in accordance with military law (by degradation, dismissal from service and other like penalties) for infractions of the law of the land, they are answerable in time of peace for such infractions, in the first instance, to the civil authorities and triable in the ordinary courts of law. An interesting controversy on this subject arose while the Pershing expedition was in Mexico on its hunt for the bandit Villa. Several men were accused of violations of the local law, and the question was whether they should be delivered to the civil authorities for trial in the Mexican courts, or whether they should be judged by their own proper military tribunals. The United States were not at war with the Mexican government and, out of respect for Mexican punctilio, the authorities at Washington had disavowed any interpretation of its intervention as purposing an occupation. The conditions under which military penalties are usually applied to civil offenses, therefore, did not exist. It was finally decided that when an armed force enters foreign territory to carry out orders of its own sovereign superior, it cannot be assumed to submit itself to the civil jurisdiction of the country thus entered; that a condition simulating war exists and that martial law prevails in the zone of operations and so far as the members of the expedition are concerned. The obscurities on this point have since been removed by the amended Articles of War, adopted by Congress in 1916.

The greatest part of the military law of the United States is statutory and its most important provisions are contained in the Articles of War. These statutes, like other enactments of Congress, are subject to interpretation by the higher civil courts, and judicial decisions interpreting the law in cases as they arise are of equal authority with the statutes themselves. Among other forms of written military law may be mentioned the decisions of the President and Secretary of War; the opinions of the Attorney-General and Judge Advocate-General; the Army Regulations and the General Orders of the War Department. The latter include the famous «General Order No. 100 (of 1863) for the Conduct of American Armies in the Field.» There is also a body of well-established usages, known among military men as the «law of war,» which corresponds to the common law in binding force. A distinction is made between military and martial law; but martial law, with respect to the army, is merely military law under war conditions. In a state of war the penalties for offenses of a military character greatly increase in severity. Desertion and insubordination are, and neglect of duty may be, punished with death. A sentinel found asleep at his post «shall suffer death, or such other penalty as a court martial may direct.» Persons in the military service who, in time of war, commit larceny, robbery, burglary, arson, mayhem, manslaughter, murder, rape or assault and battery with intent to kill or to accomplish a rape, are not punishable by the civil courts but by the sentence of a general court-martial. The military courts may also take cognizance of other offenses than those enumerated when committed by military persons in time of war. The sentence of a court-martial shall not be less than the penalty provided for by the civil law of the place. When a crime is committed by an American soldier in a hostile country against the inhabitants thereof, it is not only punishable as at home, but, in all cases in which the death penalty is not ordinarily inflicted, the severer penalty shall be preferred. This last-mentioned rule is really a part of the unwritten law of war and, specifically, of the «law of hostile occupation» or «military government.» It is difficult, however, to distinguish between the various kinds of military law as applied to individuals. Both the statutory law of the United States (which is national) and the common law of war (which is international), provide penalties for wrongs done to the inhabitants of occupied territory. For instance, it is declared in the Articles of War that, an officer or soldier who does violence to a person bringing provisions to a camp in foreign parts may, and one who forces a safeguard shall, suffer death.

With respect to civilians the ordinary civil and criminal laws are not, ipso-facto, suspended when a nation is at war, though in a zone of actual operations military rule may be established and martial law enforced. But in hostile territory occupied by an invading army the functions of civil government cease, or continue only with the sanction and, if deemed necessary, the participation of the occupier. The latter may, and will, continue in force the territorial law, to be administered as between the civilian population and, as far as practicable, by the local magistracy, when to do so is not in conflict with provisions for the security, maintenance and efficiency of the occupying army or the success of its operations. But the government of occupied territory is of necessity military and any violation of the law of war by a civilian comes under the jurisdiction of the military tribunals of the occupier. Relieving the enemy with money, food or ammunition; harboring or protecting an enemy; aiding war prisoners to escape, or destroying railroads, bridges, telegraphs, etc., are war crimes. Any secret or unauthorized communication with the enemy is considered treasonable by the law of war. Foreign residents in occupied territory, or foreign visitors in the same, can claim no immunity from this law. They may communicate with foreign parts so far as the military commander permits and no further. A war crime is always severely punished. The penalty for war treason is death, when the offense consists in the betrayal to the enemy of anything concerning the condition, safety, operations or plans of the troops holding or occupying the place or district. The law of war, like the criminal law, takes no account of sex, concerning the spy, the war traitor or the war rebel. (General Order No. 100, Art. 102). Most of the offenses indicated above as crimes under the common law of war are also defined as crimes in the statutory law of the United States. They are punishable in accordance with the latter law. whether or not committed within zones of operation or in hostile occupied territory. Martial law at home is a mere euphemism for military government as a domestic fact. It is an extension of military power over persons and things not ordinarily subject to it, and such power may be exercised in time of war, insurrection or rebellion in parts of the country retaining allegiance. Whenever feasible, martial law is carried out in cases of individual offenders by military tribunals. (General Order No. 100, Art. 12).

Courts-martial are tribunals created by the order of a proper convening authority and are empowered to try accusations, reach findings of guilt or innocence and to impose appropriate sentences. Their sentences, however, have no legal validity of themselves, being in the nature of recommendations merely. until they have received the approval of a military commander, designated by law for this purpose, who is called the reviewing authority. Only with such approval or confirmation do the sentences of these tribunals become operative and acquire the same sanction as the sentences of civil courts having criminal jurisdiction. Courts-martial differ from civil tribunals not only in the nature and extent of their jurisdiction but also in the manner of their creation. Civil courts are created by statutes which define their composition and endow them with appropriate powers, and which make them permanent institutions of the State. Courts-martial, on the other hand, though authorized by statute, are created in every instance by military orders issued by the commander-in chief or other officers empowered by the Articles of War to call them into being. When the case, or cases, referred to a court-martial for trial have been disposed of, the tribunal is dissolved by the authority that created it and ceases to exist.

Courts-martial may be composed only of commissioned officers and are of three grades — general courts-martial, special and summary courts-martial. Special and summary courts-martial are tribunals of limited powers, appointed by the commandants of garrisons, forts, camps or other places where troops are on duty, for the enforcement of discipline among the rank and file of their commands. They have no jurisdiction over commissioned officers nor over the more serious military offenses. Special or summary courts-martial can impose no penalties more severe than imprisonment and loss of pay for six or three months, respectively. Non-commissioned officers cannot be tried by a summary court, if they object, without authority of a superior officer who would be competent in law to bring them to trial before a general court. Neither may a summary court try a soldier holding the privileges of a certificate of eligibility to promotion to commissioned rank. Special courts-martial are composed of three officers of the regiment, corps or other detachment, or of the camp or garrison, for which they are appointed. A summary court for a detachment or post in which there is but one commissioned officer may consist of that officer alone; but its judgments, in that event, cannot be carried out without the special approval of a superior authority if they involve penalties greater than one month's imprisonment and forfeiture of pay. As its name implies, the procedure of this court is summary. The officer constituting the court is not sworn, but performs his duty under sanction of his oath of office. When the accused party in arrainged, if his plea be guilty, he is given an opportunity to make a statement and to introduce testimony in respect to character. If the plea be not guilty, the trial proceeds in the usual manner, but the evidence is not recorded. The commanding officers who are empowered by law to approve the sentences of inferior courts-martial have power, also, to remit or mitigate the same.

General courts-martial may be appointed by the President, the commanding officer of any territorial division or military department, the commanding officer of an army, a field army, an army corps, a division or a separate brigade. Also, whenever necessary, and when empowered by the President, by the commanding officer of any district or of any force or body of troops. When any commander is the accuser or prosecutor the court shall be appointed by a superior competent authority. No officer shall be eligible to sit as a member of such court when he is the accuser or a witness for the prosecution. General courts-martial have the most extensive jurisdiction of all military tribunals, both in respect to persons and cases. They are empowered to try any military person, whatever his rank, for any act made punishable by the Articles of War; also any other person, civilian or military, who, by the statutes of the United States or the common law of war, is subject to trial by a military tribunal. General courts-martial have the power to impose the death penalty, which special and summary courts have not. General courts-martial may consist of any number of officers from 5 to 13. They shall consist of the larger number when that many officers can be convened without manifest injury to the service. But the judicial functions of general courts-martial may be exercised only by properly constituted tribunals of at least five members. A less number is without power to enter upon the trial of a case, to proceed with a trial already begun or to perform any act of a judicial character. The number of officers who shall compose a particular court is determined in conformity with the statute by the convening authority, and his conclusion in that regard is final. No officer or soldier put in arrest shall be continued in confinement more than eight days or until such time as a court-martial can be assembled. The procedure of courts-martial is substantially the same as that of civil courts having criminal jurisdiction. The accused may challenge any member of the court for cause, but peremptory challenges are not allowed. The court and judge-advocate are sworn and witnesses are put to their oath. The allegations against the accused are embodied in charges and specifications which correspond with the indictment and counts in ordinary criminal actions. When arraigned, the accused may plead to the jurisdiction, in bar of the trial, or in abatement of the action. When these pleas are exhausted, or if none of them is resorted to and a plea to the general issue is made, the case goes to trial on its merits. The rules of evidence are those which regulate the admission of testimony in criminal cases in the courts of the United States. See Habeas Corpus; High Treason; Military Courts Martial; and consult 'Regulations of the Army of the United States' (Washington, Government Printing Office, 1916, containing the revised Articles of War); 'Rules of Land Warfare' (issued by the War Department — Office of the Chief of Staff, Washington 1914).

Stephen Pfeil.

LAW, Moral. See Moses.

LAW, Municipal. See Government; Municipal Government.

LAW, Natural. Many laws have been found necessary to regulate the conduct of man in his various relations to society which are more or less arbitrary according to the requirements of localized conditions, but underlying them all are the laws of nature.

If a man kill an animal and eats of its flesh he has no reason to conceal the act; he goes his way with a full stomach and a clear conscience, and no one charges him with the commission of crime. He has simply conformed to the law of nature and answered the instinct of self-preservation. But if a man kill another man, his whole deportment, and even the expression of his features, indicate the consciousness of guilt and fear. Natural law might be said to be the law dictated by conscience, not law deduced from man's education and experience in the world — law regulating his own general rights and duties in relation to the moral government of God, or Nature, and his own moral capacity and accountability.

So natural law covers a man's duty to God, or Nature — the duties of man toward himself, such as self-preservation, temperance, etc.; the duties of man toward other men or duties which arise from his relations to others near or dear to him; and finally the duties of man, generally and politically, to universal society, especially to the community in which he lives.

At different periods of the world's history men have had various conceptions of justice. Self-preservation was the basis of law among the Sophists of Greece and the Epicureans; the Stoics believed that natural law was founded upon reason and used the term «rational law.» Aristotle conceived natural justice to be partly legal (made by man) and partly natural (dictated by God).

Natural law, or *jus naturale,* as defined by Roman philosophers and jurists, is that law which is naturally discerned by right reason, as opposed to the law found necessary and made by man for the safe conduct of the state under localized conditions or by agreement for the preservation of international rights. Later, however, they distinguished *jus naturale* from *jus gentium,* the former being known by Ulpian's definition, «Natural law is that which nature has taught all living things,» and the latter including the laws of expressed or implied agreement between men, or humanistic laws. Aristotle interpreted natural law simply as the law of nations; the Stoic conception was that natural law makes all men free, but that the law of nations permits slavery. The Epicureans thought that commercial trade or profit-making came under natural law. In the administration of Roman justice, natural law was often referred to in justification of an act of judgment, but the validity of a Roman law was never questioned because opposed to natural law.

During the Middle Ages natural law seems to have been considered mostly in its humanistic aspect, that is, in its acquired or necessary application to particular conditions. Owing to the dominant religious trend of the period, natural law came to be identified with the law of God. And in the development of English and Continental law there seems to exist a stronger inclination to consult the flexible laws of human reason rather than the immutable rules of natural law.

During the 17th and 18th centuries the theories and doctrines of natural law formed an important part of the discussions in relation to international law, general jurisprudence, politics and political economy. This was particularly true in relation to the rehabilitation of the laws relating to liberty, personal rights, property-holding, etc. But in the end utilitarianism played a more important part in the period of legal reconstruction and reform.

When jurisdiction passed from ecclesiastical authorities to the people at large, the popular theory that conscience is the true interpreter of law (consult the writings of Marsiglio of Padua, c. 1270–c. 1343) developed a strongly anarchistic trend, in that it made each man an arbiter of right and wrong, from whom no appeal could be taken to a higher authority. This view, of course, could not be carried to its logical extreme in practice. However, in England the populace gained the privilege of participating in the constitution of government mainly through the forced recognition of the natural-rights theories which they had long asserted against the Crown. The natural rights to which claim was chiefly made in the period of the enlightenment were those to life, liberty, the pursuit of happiness and property. As will be seen, the American Declaration of Independence is an expression of the natural law theory. These same views were previously expressed in the writings of Locke and Rousseau (qq.v.), and played an important part in the French Revolution.

The theory of natural law has ever had its adherents and its enemies. One reaction against it was notably set forth by Hobbes (q.v.). It can be variously construed, according to the philosophical reasoning of the definer. Some one reasons that polygamy is against natural law, another claims that marriage should never exist at all; this one claims that it is natural for man to worship a Supreme Being, that one says that all religion is superstition and human weakness, and is not a natural desire. Unless, indeed, we assume that fundamentally all men's consciences are the same, the interpretation of natural law is dependent upon the moral sensibilities of the individual. However, owing to the great measure of uniformity which actually exists in human nature, there is a certain highest common factor of the many diverse consciences of mankind, and this common factor is recognized in the formulation of all legal issues. This common element does not owe its existence to anything a priori in the nature of morality, but to the de facto homogeneity of the human race. It can be seen that a community less in extent than the human race will possess more homogeneity, and accordingly it will possess a natural law more developed in details. (See LAW; CIVIL LAW; INTERNATIONAL LAW). Consult Abbot, E. B., 'Justice and the Modern Law' (New York 1913); Ahrens, 'Cours de droit naturel' (8th ed., Leipzig 1892); Ansilotti, 'La scuola del diritto naturale' (Florence 1892); Bergbohm 'Das Naturrecht der Gegenwart' (Leipzig 1892); Bryce, Viscount, 'The Law of Nature,' in 'Studies in History and Jurisprudence' (New York 1901); Gierke, 'Johannes Althusius und die Entwickelung der Naturrechtlichen Staatstheorien' (Leipzig 1880); Rothe, 'Traité de droit naturel' (Paris 1884–95).

LAW, Parliamentary. See PARLIAMENTARY LAW.

LAW, Patent. See PATENTS, THE LAWS OF.

LAW, Physical. See PHYSICS.

LAW, Public. See PUBLIC LAW.

LAW OF FAMILY, The. See FAMILY LAW.

LAW OF HUSBAND AND WIFE, The. See HUSBAND AND WIFE.

LAW OF MARRIAGE. See MARRIAGE, LAW OF.

LAW MERCHANT, The. The law merchant was a system of law which grew up in Europe during the Middle Ages for the regulation of the dealings of mariners and merchants in all the commercial countries of the world. It comprised much of what is found in the modern codes of maritime and commercial law.

Four features of the law merchant may be noted: First, it was customary law, unwritten in form, and not emanating from any legislative body. It developed to meet the needs and usages of commerce. Second, its procedure and operation were summary in character. The justice dispensed was prompt, speedy and sure. Thus it was designed to meet the needs of the merchant class who wanted their disputes settled quickly. Third, it was permeated by the principles of equity, justice and good faith. It was eminently practical and disregarded technicalities. Fourth, it was international in character. It has often been defined as the «private international law of the Middle Ages.» It originated, not in any one country, but in the commercial countries of the civilized world. It applied to alien and citizen alike provided he was a merchant or mariner.

The law merchant has now become more or less definitely incorporated into the formal legal systems of the nations of the world, although in some cases, as in Germany and France, it is still administered by separate courts.

The evolution of the law merchant in England has been an important chapter in legal history inasmuch as England has been a great law-giving nation as well as a nation dependent to an unusual degree upon trade and commerce.

In the Middle Ages the law merchant in England comprised both maritime and commercial law and was administered in special local courts created for that purpose in the important commercial cities of England. These courts were sometimes the courts created to dispense justice at the commercial fairs. In the larger cities special courts grew up for the express purpose of administering the law merchant. Their jurisdiction was recognized by the English statutes.

In the reign of Edward III separate admiralty courts were created for the trial of maritime and piracy cases, thereby limiting to commercial actions alone the jurisdiction of the courts of the law merchant. The common law courts as they developed became jealous of competing tribunals and by the end of the 16th century had succeeded in transferring from the jurisdiction of the law merchant to that of the common law all cases arising in internal trade. By the end of another century these special mercantile courts had disappeared entirely and the ordinary courts of common law and equity had assumed jurisdiction in commercial matters. The principles of the law merchant were not, however, lost. Litigants could still have their cases decided in accordance with them by «proving» such principles as foreign law is now proved, in other words, by convincing the common-law courts that such principles were recognized by the customary law of commercial intercourse. When thus «proved» the principle of the law merchant became part of the law of the land. It thus became amalgamated into the general system of the English law.

Consult Carter, 'A History of English Legal Institutions' (4th ed., Chap. 27, 1910); Holdsworth, 'A History of English Law' (1903, Vol. I, Chap. 7); Mitchell, 'The Law Merchant' (1904); 'Select Essays in Anglo-American Legal History,' by various authors (1907).

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LAW OF NATIONS. See INTERNATIONAL LAW.

LAW SCHOOLS. See LAW, AMERICAN SCHOOLS OF; EDUCATION, PROFESSIONAL.

LAW TERMS, space of time prescribed by law in which a court may be in session with adjournments from day to day, or time to time, until its adjournment *sine die*. In the United States a «regular» term is one begun at a time fixed by law and adjourned at the discretion of the court in consistency with the law. A «special term» is held by a single justice presiding over motions and causes of equitable nature, as opposed to the «general term» with three justices, held for the consideration of appeals. The original conception of the term, dividing the year into law terms, was abolished in the United States at the time of the Revolution and in England has been superseded by an arrangement by which the Supreme Court of Judicature has four sittings each year: Michaelmas, 2 November to 21 December, but by order of council commencing 24 October; Hilary, 11 January to the Wednesday preceding Easter; Easter, Tuesday after Easter week to Friday before Whitsunday, and Trinity, Tuesday after Whitsun-week, to 8 August, but ending by order of council on 12 August.

LAWES, lâz, **Henry,** English composer: b. Dinton, Warwickshire, 1596; d. London, 21 Oct. 1662. He was a brother of William Lawes (q.v.) and was educated as a classical musician. He became famous as a composer for masques and songs, and he is eulogized by Milton in several poems. He set to music the poet's 'Masque of Comus' and supervised its production at Ludlow Castle in 1634. He published 'Ayres and Dialogues, for One, Two and Three Voices' (1653).

LAWES, SIR **John Bennett,** English chemist: b. Rothamsted, Hertfordshire, 28 Dec. 1814; d. there, 31 Aug. 1900. He was educated at Eton and at Oxford, whence he went to London, and there remained for a while engaged in the practical study of chemistry. Reaching his majority, he came into possession of his estate, where he undertook experiments in agricultural chemistry in the interest of a more scientific method of agriculture. In 1843 he employed Dr. (afterward Sir) J. H. Gilbert as superintendent of laboratory work at the Rothamsted farm, and uniting his own labors with those of his colleague, by a course of investigations, indoors and out, developed scientific processes whereby superphosphate of lime came to be used as a fertilizer. For over 50 years they carried on these labors together, and important practical results for improved agriculture are recorded to their credit. In 1899 Lawes transferred his laboratories and experimental fields, with an endowment amounting to about £100,000, to a board of trustees, in order to secure their permanent usefulness. He was created a baronet in 1882. Consult Hall,

A. D., 'The Book of the Rothamsted Experiments' (1905).

LAWES, William, English composer: d. Chester, England, 1645. He was an elder brother of Henry Lawes (q.v.), with whom he was associated in various musical matters, and not only wrote music for many of the songs of the time, but the music for Shirley's masque, 'The Triumph of Peace' (1636), and for Sandys' version of the Psalms, published in 1648.

LAWES, William George, English Congregationalist clergyman: b. Aldermaston, Berkshire, 1 July 1839; d. 1915. He was ordained in the Congregationalist ministry in 1860 and was appointed to the South Sea Mission by the London Missionary Society, serving there in 1861–71. After a furlough in England he was, in 1874, sent to New Guinea where he was the first European resident and pioneer missionary in British New Guinea. He took part in the proclamation of the British protectorate in 1884 and in the annexation to the British Empire in 1888. He founded a college for natives at Vatorata, New Guinea, in 1896 and was its president until 1906, when he retired to Sydney, New South Wales. He translated parts of the Bible into Motu and was author of 'Grammar of Motu, New Guinea Language' (1895; 3d ed., 1896).

LAWES-WITTEWRONGE, lâz'wĭt'rông, Sir **Charles,** English sculptor: b. Teignmouth, 3 Oct. 1843; d. 6 Oct. 1911. He was educated at Trinity College, Cambridge, succeeded his father as baronet in 1900, and in 1902 assumed by royal license the additional name of Wittewronge. His work as a sculptor is characterized by strength and vigor of line and usually is full of action. He was an ardent sportsman and was keenly interested in agriculture. He was president of the incorporated Society of British Sculptors and chairman of the Lawes Agricultural Trust. Among his well-known works are the bronze group 'They Bound Me On' (1888) and the high relief of 10 female figures called 'United States of America' (1890).

LAWLESS, Emily, Irish novelist, daughter of the third Baron Cloncurry: b. 1845; d. 21 Oct. 1913. She has published several popular romances of Irish life, full of pathos and picturesqueness, among which are 'Hurrish: a Study' (1886); 'Grania,' her most powerful work (1892), and 'Maelcho,' a story of the rebellion of Sir James Fitzmaurice in the 16th century (1894). She is also the author of 'Ireland,' in the 'Story of the Nations' series (1890); 'A Garden Diary' (1901); 'With the Wild Geese,' poems (1902); 'Maria Edgeworth,' a biography (1904), and 'The Book of Gilly' (1906).

LAWLEY, Alethea Jane Wiel, English historical writer: 2d daughter of the 2d Baron Wenlock. She was married to the Cavaliere Tatteo Wiel in 1890 and lives in Italy. She has published 'Vittoria Colonna,' a study (1888); 'Venice,' 'Story of the Nations' series (1894); 'The Romance of the House of Savoy' (1898); 'Verona,' in 'Mediæval Towns' series (1902); 'The Navy of Venice' (1910), etc.

LAWLEY, George, American yacht builder: b. London, England, 1823; d. 27 Feb. 1915. He emigrated to the United States in 1851 where he engaged in shipbuilding. His firm, Lawley & Son, Boston, built the *America's* cup defenders the *Puritan* (1885) and the *Mayflower* (1886). The *Volunteer* defender was a joint product of the Lawley yards and of builders at Wilmington, Del. The *Vanitie,* which in 1914 failed to qualify for the *America's* cup race, was also built under Lawley's supervision.

LAWN, finely woven white goods, cotton or linen, of an open texture, plain or printed. The white sleeves, which form a part of the dress of a bishop in the English Church, are made of lawn.

LAWN-TENNIS, a modern game, played on grass, gravel, cinder or asphalt courts, with balls and rackets. The face of the racket is now invariably plane, and consists of a net formed of tightly-strung gut. The balls are of rubber covered with white flannel, about two and one-half inches in diameter and two ounces in weight. For a game between two players (a single-handed game) the court is 78 feet long by 27 wide. It is divided across the middle by a net, the ends of which are attached to two posts, which stand three feet outside the court on each side. The height of the net is three and one-half feet at the posts and three feet at the centre. At each end of the court, parallel to the net and 39 feet from it, are drawn the base-lines, the extremities of which are connected by the side-lines. Half-way between the side-lines, and parallel to them, is drawn the half-court line, dividing the space on either side of the net into two equal parts called the right and left courts. On either side of the net, at a distance of 21 feet from it, and parallel to it, are drawn the service-lines. The players take up their positions on opposite sides of the net and one of them, decided by tossing, called the server, standing with one foot behind and one foot on the base-line, serves the ball from his right court into the diagonally opposite court. The ball is served by being struck with the face of the racket while it is in the air, and the stroke is counted a fault if the service be from the wrong court, or if the server do not stand as directed, or if the ball do not strike the ground in the diagonally opposite court within the service-line. After a fault the server must serve again from the same court, unless the stroke was a fault because served from the wrong court. The next service comes from the left court, and thereafter the courts are taken alternately. The non-server is called the striker-out, and it is his business to return the ball by striking it with the face of his racket. The server wins a stroke if the striker-out "volley the service," that is, strike the ball before it touches the ground, or fail to return the service or the ball in-play, or return the service or the ball in-play so that it drop outside any of the lines which bound his opponent's court, or otherwise lose a stroke in accordance with the recognized laws of the game. The striker-out wins a stroke if the server serve two consecutive faults, or fail to return the ball in-play, or return the ball in-play so that it drop outside any of the lines which bound his opponent's court, or otherwise lose a stroke. On either player winning his first stroke the score is called 15 for that player; on either player winning his second stroke the score is called 30 for him; on either winning his third stroke his score is called 40, and the fourth stroke won by either player is scored game for that player. However, if both players have won three strokes, the score is called deuce, and the next stroke won by either player is scored advantage for that player. If the same player win the following stroke, he wins the game; but if he lose the next stroke, the score is again called deuce, and so on until one player win two strokes immediately following the score at deuce. The player who first wins six games wins a set, but with both at five a method of scoring similar to advantage is often introduced. Sides are changed at the end of every set. Three-handed and four-handed lawn-tennis differ in no essentials from the game as above described. The game of lawn-tennis as now known was introduced about 1875.

Bibliography.— Dewhurst, E. B., 'Science of Lawn Tennis' (Philadelphia 1910); Doherty, R. F. and H. L., 'On Lawn Tennis' (New York 1903); Heathcote, J. M., 'Tennis, Lawn Tennis and Racquets' (new ed., London 1903); Lambert-Chambers, D. K. D., 'Lawn Tennis for Ladies' (New York 1910); Little, R. D., 'Tennis Tactics' (ib. 1913); Myers, A. W., 'Lawn Tennis at Home and Abroad' (ib. 1903); id., 'Complete Lawn Tennis Player' (Philadelphia 1908); Paret, J. H., 'Lawn Tennis: Its Past, Present and Future' (New York 1904); Walsh, G. E., 'Making a Tennis Court' (ib. 1912); Wright and Ditson, 'Official Lawn Tennis Guide' (Boston, annually); Spalding's Athletic Library, 'Lawn Tennis' (New York, annually); 'Lawn Tennis Handbook' (London, annually).

LAWNS: Their Preparation and Care, a closely-mown turf maintained for ornament in parks and private grounds. It may or may not be dotted with trees, shrubs or other specimen plants, or even with flower beds. These are, however, mere incidents, and since they usually detract from the natural beauties of an open sward, should usually be confined to the borders in irregular, rather than formal, order. The lawn thus becomes the canvas and the side-planting the frame for a natural picture in which the dwelling or other prominent feature is placed.

Whether the contour of the surface be level, convex or concave, it should always be graded so as to avoid even slight irregularities, and where the land is rolling all three contours should be harmoniously blended so as to avoid breaks such as terraces, and so as to ensure the repose that comes from such blending. Except on sand and clay, lawns do well on practically all soils if properly prepared and maintained. After the grading the land should be plowed, dug, or forked, as deeply as the soil will permit, even to the depth of two feet, then harrowed thoroughly, removing all stones and burning all rubbish, weeds, etc. A liberal dressing of complete fertilizer containing potash, phosphoric acid and nitrogen in readily available forms should be given, and where possible a covering of an inch or more of rich soil is often of decided advantage. Except for their containing seeds of weeds, animal manures are especially valuable, that of sheep and cattle being usually better than ordinary stable-manure; when the latter is applied it should always be after thorough composting and rotting to destroy weed-seeds. The surface being very smooth, the fertilizer well harrowed in and the wind asleep, seeding may be performed, preferably just before rain. The seed should be the purest that can be obtained, and may or may not be raked in, but the land should always be heavily rolled. In the Northern States the popular grasses for lawns are Kentucky bluegrass, which is especially valuable for soils rich in lime, red-top and Rhode Island bent-grass. (See GRASSES). Mixtures of several grasses are valuable because the grasses that start first choke out weeds and are later themselves choked out by the slower-growing blue-grass.

When the grass is three inches tall it should be cut with a scythe, and afterward with a lawn-mower as occasion may require. In the autumn a dressing of well-composted manure should be given, and in the spring the strawy useless parts should be raked off before growth starts. After the frost is out of the ground the lawn should be rolled to compact the turf, which usually heaves more or less during the winter. It is further essential that weeding be performed every year, but especially during the first, second and third. If desired, a sprinkling of white clover (*Trifolium repens*) may be given by sowing the seed after or before the grass seed; being of different weights, they cannot be sown together. White clover may also be sown upon heavy and poor soils, where it will often make a good stand and a good precursor for grass. In the South the grasses mentioned usually fail, and should be replaced by species that can withstand the climatic conditions. The most satisfactory and popular are Bermuda grass, joint grass and Saint Augustine grass. The first is usually propagated by passing the roots, freed from soil, through a feed cutter, sowing and harrowing the pieces.

Small lawns are frequently made by transplanting sod from old pastures, in which cases the turf is cut in long strips about 15 inches wide, rolled up and laid down like carpet, and then pounded or heavily rolled to press the roots firmly against the soil. The subsequent management should be that given seed-sown lawns. Owing to the dryness of the summers in many parts of the United States lawns are often considered failures. Too frequently, however, these results follow imperfect preparation and improper management. As a rule lawns should not be watered while they are young or in the early part of the season, because this tends to keep the roots near the surface and to make the grasses less able to withstand dry weather. Water should therefore be withheld until the plants seem to be in dire need, and then it should be applied in what may seem excessive quantities. Consult Barron, Leonard, 'Lawns and How to Make Them' (New York 1906); Corbett, L. C., 'The Lawn' (in 'Farmers' Bulletin No. 248' Washington 1906); Doogue, L. J., 'Making a Lawn' (New York 1912); Kelligan, C. P., 'Starting a Lawn' (in 'Circular No. 20,' of the Michigan Experiment Station Lansing 1913); Schreiner and Skinner, 'Lawn Soils' (in 'Farmers' Bulletin No. 494' Washington 1912).

LAWRANCE, John, American lawyer, soldier and legislator: b. Cornwall, England, 1750; d. New York city, November 1810. He emigrated to America in 1767, settling in New York, where he was admitted to the bar in 1772. He early attained a considerable success as a lawyer, and at the outbreak of the Revolution warmly espoused its cause. He received an officer's commission in the First New York regiment, serving under his father-in-law, Gen. Alexander MacDougall. He was appointed aide-de-camp to Washington in 1777, and in October of that year presided over the trial of Major André. He returned to the practice of law after the war, and in 1785–87 was a delegate to the Continental Congress. He was an ardent supporter of the constitution proposed by the Federalists, and lost his seat to an anti-Federalist in 1788. He served in the New York State senate in 1789 and was elected the first representative of New York city in the first United States Congress, 1789–91, succeeding himself in the second Congress, 1791–93. In 1794 he was the first justice appointed to the United States District Court of New York, resigning upon his election to the United States Senate in 1796. He served as president pro-tempore of the Senate in 1798–99. Lawrance was a personal friend of both Washington and Hamilton.

LAWRENCE, Abbott, American manufacturer and diplomatist: b. Groton, Mass., 16 Dec. 1792; d. Boston, 18 Aug. 1855. In 1814 he became one of the firm of A. and A. Lawrence, which for many years conducted a prosperous business in the sale of foreign cotton and woolen goods on commission, and later established a cotton industry in Lowell, Mass., with his brother Amos (q.v.). He was a member of the 24th Congress and again 1839–40. He was a commissioner in 1842 to settle the Northeastern Boundary question and arranged a basis for settlement with Lord Ashburton which was satisfactory to both the United States and England, and was Minister to Great Britain in 1849–52. He founded the Lawrence Scientific School of Harvard University, to which he gave $100,000; and was a liberal philanthropist. Consult Hill, A. H., ‹Memoir of Abbott Lawrence› (2d ed., Boston 1884).

LAWRENCE, Amos, American merchant: b. Groton, Mass., 1786; d. Boston, 31 Dec. 1852. He was educated in his birthplace at an academy founded by his father. He worked for many years as a clerk and in 1807 started at Boston a dry-goods business of his own, formed a partnership with his brother (1814) and began a large wholesale business. Lawrence and Lowell became the centres of this firm's manufacturing activity which soon placed them at the head of the cotton-spinning and weaving trade. Amos Lawrence retired from active business in 1831 through ill health and spent much of his later years in promoting works of philanthropy and patriotism. The academy at Groton, of which he was a liberal benefactor, was named Lawrence Academy in his honor (1843); he contributed liberally to the raising of the Bunker Hill monument and made large contributions to Williams College. Consult ‹Extracts from the Diary and Correspondence of Amos Lawrence with a Brief Account of Some Incidents in His Life› (1855).

LAWRENCE, Amos Adams, American philanthropist: b. Boston, Mass., 31 July 1814; d. Nahant, Mass., 22 Aug. 1886. He was graduated at Harvard University in 1835, invested extensively in cotton manufactories and later became interested in various industrial corporations and banking firms. He served as an officer in various charitable institutions and was principal manager of the Emigrant Aid Association organized to aid in the colonization and maintenance of Kansas as a free State, in which connection he was associated with Eli Thayer and others in 1853–54. The town of Lawrence in Kansas was named in his honor. In the Civil War he was active in recruiting the 2d Massachusetts Cavalry regiment. He was one of the founders of Lawrence College, Appleton, Wis., and he built Lawrence Hall, the Episcopal Theological Seminary, at Cambridge.

LAWRENCE, Frederick William Pethick, English social reformer and barrister-at-law: b. 28 Dec. 1871. He was educated at Trinity College, Cambridge, and in 1897 was elected a Fellow there. He made a tour around the world investigating social conditions, and in 1899–1901 lived at the Mansfield Settlement House, Canning Town. He made an effort to enter Parliament but his opposition to the South African War defeated him. He purchased a controlling interest in the *Echo* in 1901 and edited it until its demise in 1905, when he personally settled its obligations. He was associated with Mrs. Pankhurst in the militant demonstrations of the Woman's Suffrage Party and was joint editor of *Votes for Women* in 1907–14. He was sentenced to nine months' imprisonment for connection with a destructive raid of the militant suffragists in 1912 and was ordered to pay the costs of the prosecution. Upon his refusal he was declared bankrupt, the bankruptcy being annulled after the court had deducted the costs of the trial from the estate. In 1916 he became honorary treasurer of the Urban District Council. Author of various papers on mathematics, economics, free trade and woman suffrage, and ‹Local Variations in Wages›; ‹Woman's Fight for the Vote›; ‹The Man's Share›; ‹Reformer's Year Book, 1904–08.›

LAWRENCE, George Alfred, English novelist: b. Braxted, Essex, 25 March 1827; d. Edinburgh, Scotland, 23 Sept. 1876. He was educated at Oxford, studied law, but soon turned his attention to fiction and became suddenly famous by his novel, ‹Guy Livingstone, or Thorough› (1857). He was much read in America as well as in his own country, and ‹Sword and Gown› (1859); ‹Breaking a Butterfly› (1869) and other works gave him an evanescent popularity. His ‹Border and Bastile› (1863) has an autobiographical interest, in which he records his adventures in the United States, undertaken with a view to joining the Confederate army. He was taken prisoner by Federal troops before his purpose could be accomplished, and was only released on condition that he return to England.

LAWRENCE, George Newbold, American ornithologist: b. New York, 20 Oct. 1806; d. 1895. He was privately educated, was for some years in the drug business, but in 1867 retired, and thereafter devoted himself to ornithology. From 1846 he contributed to the literature of ornithology; and he also made an extensive and valuable collection of birds, including 8,000 specimens, representing almost every variety found in the United States, and an excellent series of the birds of Mexico, Central America, the West Indies and South America. This collection he sold to the American Museum of Natural History. He assisted Spencer F. Baird and John Cassin in the preparation of 'The Birds of North America' (1860). He was a member of many scientific societies.

LAWRENCE, James, American naval officer: b. Burlington, N. J., 1 Oct. 1781; d. 5 June 1813. He entered the navy as a midshipman 4 Sept. 1798; in 1800 was made acting lieutenant and in April, 1802, lieutenant, and served during the war with Tripoli; he was first lieutenant of the schooner *Enterprise* and one of the party which boarded and destroyed the frigate *Philadelphia* in the harbor of Tripoli on the night of 15 Feb. 1804. Shortly before peace was concluded he was given command of a gunboat, and on his return to the United States, served as first lieutenant of the *Chesapeake* and subsequently commanded the *Vixen*, the *Wasp* and the *Argus*. In November 1810 he was promoted to the rank of master commandant and given command of the *Hornet*. In 1812 he cruised in the *Hornet* with Commodore Bainbridge's squadron along the South American coast, and at the mouth of the Memerara River he met the British brig *Peacock*, which after a severe action of about 15 minutes he forced to surrender. When she surrendered, the *Peacock* was badly damaged and sinking, and Lawrence transferred the crew to his own ship. (See HORNET). On 14 March 1813 he was promoted to the rank of captain and appointed to the frigate *Chesapeake*, then lying in Boston; the *Hornet* was also placed under his orders and it was intended that the two ships should sail against the Greenland whale fishery. On 1 June 1813, when the *Chesapeake* was ready for sea, Lawrence sailed out of the harbor to meet the British ship *Shannon;* after a severe battle he was forced to surrender, and his ship was taken as a prize into Halifax. (See CHESAPEAKE AND SHANNON, BATTLE OF). Lawrence was fatally wounded and died four days after the battle; throughout the action he showed the greatest coolness and courage, and his last words as he was carried from the deck were, "Don't give up the ship." Consult Gleaves, Albert, 'J. Lawrence, Captain U. S. Navy' (New York 1904); Niles, J. M., 'Life of O. H. Perry' (Hartford 1821); Roosevelt, 'Naval War of 1812' (2 vols., New York 1904).

LAWRENCE, John Laird Mair, 1ST BARON LAWRENCE, English viceroy and governor-general of India: b. Richmond, Yorkshire, 24 March 1811; d. London, 26 June 1879. He was a younger brother of Sir Henry Montgomery Lawrence and of Sir George Saint Patrick Lawrence, both of whom attained distinction in India. He was educated at Foyle College, Londonderry, at Wraxall Hall, Clifton, Haileyberry College and the College of Fort William, Calcutta. He mastered Urdu and Persian, and in 1830 he was appointed assistant to the collector at Delhi. With brief intermissions he was for 20 years magistrate and land revenue collector in that district, gaining a thorough understanding of the natives and so administering affairs for their comfort and prosperity that he gained a wide influence with them. He was responsible for beneficent land reforms and was also largely instrumental in preventing oppression of the people by their own chiefs. At the outbreak of the first Sikh war he was able to raise and forward supplies and munitions of war which resulted in the victory at Sobraon. He then administered the territory of the defeated Sikhs with such success that in the second Sikh war he was able again to come to the rescue, with the result that the Punjab was annexed and Lawrence appointed commissioner and then lieutenant-governor. In the seven years before the outbreak of the Indian Mutiny he so pacified the territory as to be able to send troops to the relief of Delhi and other hard-pressed points, and earned for himself the title "the savior of India." He was knighted in 1858 and upon his return to India received the thanks of Parliament and a pension of £2,000 annually in addition to his regular pension of £1,000. He became privy councillor, acting as secretary of the state's council for India, and in 1864 became viceroy and governor-general of India. His administration was uneventful but marked by the prudent care and wisdom upon which he had built his power in Indian affairs. Upon his return to England in 1869, after 40 years of service in Indian affairs, he was created a baron. For the last 10 years of his life he was chairman of the London School Board and of the Church Missionary Society. He was buried in Westminster Abbey. Consult Smith, B., 'Life of Lord Lawrence' (1885); Atchison, Sir C., 'Lord Lawrence' (in 'Rulers of India Series' 1892); Trotter, L. J., 'Lord Lawrence' (1880); Gibbon, F. P., 'The Lawrences of the Punjab' (1908).

LAWRENCE, Saint, THE DEACON, Christian martyr: d. about 258. He was deacon of Pope Sixtus II and in the persecution of Valerian he was summoned before the judge to produce the treasures of the Church. He brought with him the poor and needy of the Church as the treasures in his keeping and upon refusal to retreat from his position was sentenced to be burned on a gridiron. His martyrdom followed by three days that of Pope Sixtus. While the legend and the details as related by Saint Ambrose are doubtless somewhat enhanced by the narrator, there is no question of the occurrence of the martyrdom. He is supposed to have mocked his judge and executioners while under torment. His name appears in the canon of the Mass of the Roman Catholic Church and his calendar day is 10 August. There have been enumerated 228 churches named for him in England, and the Escurial was built in his honor by Philip II of Spain in celebration of the victory of Saint Quentin, which was won on his feast day in 1557.

LAWRENCE, Stringer, English soldier: b. Hereford, 6 March 1697; d. London, 10 Jan. 1775. He entered the army in 1727, served at Gibraltar, in Flanders and at the battle of Culloden, and in 1748 he went out to India to take command of the East India Company's troops. He defeated the French attempt to capture Cuddalore soon after his arrival, but was later captured by the French cavalry patrol at Ariancopang and was held prisoner until the peace of Aix-la-Chapelle. He was in command of the capture of Devicota in 1749, at which time

Clive served under him, a lifelong friendship ensuing. He returned to England in 1750, but in 1752 he took command of the forces intended for the relief of Trichinopoly and succeeded in forcing the surrender of the French besieging army. Later he defeated the French at Bahur, and in 1753 he once again relieved Trichinopoly and defended it for the 17 months preceding an armistice and conditional treaty. The arrival of regular forces of the Crown deprived him of the chief command in 1754, but he served under the new commander, Col. John Adlercron, in the operations around Wandiwash in 1757. He was in command of Fort George in 1758–59 during the siege by the French, and after two years in England returned to India as major-general and commander-in-chief at his old post. He presided over the reorganization of the Madras army in 1765 and retired in 1766. The monument to his memory in Westminster Abbey was erected by the East India Company.

LAWRENCE, Sir Thomas, English portrait painter: b. Bristol, 4 May 1769; d. London, 7 Jan. 1830. His father was an innkeeper, who in 1772 removed to Devizes, where the artist gave early proof of this ability by drawing portraits of his father's guests or, standing on a chair, would recite passages from Pope or Milton. At the age of six he was sent to school, where he remained two years, and this, with the exception of a few lessons subsequently in Latin and French, constituted his whole education. The family removed to Bath in 1779, where he had access to the galleries of some of the neighboring gentry, where he employed himself in copying historical and other pieces. From this time he was the sole support of his family, and by the age of 12 his studio was the resort of the beauty and fashion of Bath, his works being mainly half-size ovals in crayon. In his 17th year he began to paint in oils. In 1787 the family removed to London, and Lawrence was admitted a student at the Royal Academy; his subsequent career was successful and brilliant. He was elected in 1791 a supplemental associate by the desire of the king, being under the age (24) fixed by the laws of the institution. No other case of the kind has occurred. On the death of Sir J. Reynolds the next year he was made painter to the king. His reputation grew steadily, and he was soon considered the first portrait-painter of the age in England. His scene from the 'Tempest' was a successful attempt at historical painting. In 1794 he was made a Royal Academician and was elected president in 1820. In 1815 he was knighted by the Prince Regent, who also employed him to take the likenesses of the allied sovereigns and the most distinguished persons of their suite. During their visit to England he finished the portrait of the king of Prussia, and went to Aix-la-Chapelle several years afterward to paint the Emperor Alexander; thence he went to Vienna, where he completed the portraits of the emperor, the archdukes, Metternich, etc., and in Rome painted Pius VII and Cardinal Gonsalvi. These portraits are now in the Waterloo Gallery at Windsor and are of great historical value. Lawrence's portraits are striking likenesses and display a bold and free pencil; but they are, particularly his later ones, chargeable with mannerism; his coloring, brilliant and effective as it is, is hard and glassy, and shows little insight into character. The pleasing artificiality of his work, however gratifying to his sitters, has lowered his artistic reputation with succeeding generations. It was said of him that he never lost a sitter by an unflattering likeness. Polished and courtierlike in his manners, he was an inveterate and in main a harmless flirt, his successive proposals of marriage to the two daughters of Mrs. Siddons and subsequent withdrawals from these engagements being the only discreditable episodes in an otherwise honorable career. His income for the last 20 years of his life was very large, but he died poor, owing to the lavishness with which he spent money in acquiring the first-rate productions of his art, in assisting less fortunate artists and in other ways. His valuable and unrivaled collection of drawings by the old masters was unfortunately dispersed after his death.

LAWRENCE, Sir William, an eminent surgeon and anatomist: b. Cirencester, 16 July 1783; d. 5 July 1867. In 1799 was apprenticed to the celebrated Abernethy, and was an inmate of his house for five years. In the third year of his apprenticeship he had given such proofs of his zeal and capacity that Abernethy appointed him demonstrator in anatomy at Saint Bartholomew's, and for 12 years he discharged the duties of his office with signal ability. From 1824–65 he became principal surgeon to Saint Bartholomew's Hospital. In 1816 he published an 'Introduction to Comparative Anatomy and Physiology,' and in 1819 'Lectures on the Physiology, Zoology and Natural History of Man,' which provoked the hostile criticism of theologians. In 1829 he succeeded Abernethy as lecturer on surgery to Saint Bartholomew's, and altogether he was connected with this hospital 65 years. Shortly before his death he was made a baronet. Few men of his time did more than he for the advancement of surgery. His treatise on 'Hernia' was a standard work, and that on 'Diseases of the Eye' (1833) marks an epoch in ophthalmic surgery. His lectures on surgery were published in 1863. He was twice president of the Royal College of Surgeons and on two occasions he delivered the Hunterian oration.

LAWRENCE, William, American politician: b. Mount Pleasant, Ohio, 29 June 1819; d. 8 May 1899. He was graduated from Franklin College (1838) and at the Cincinnati Law School (1840). He early became prominent in politics, and from 1845 to 1847 owned and conducted the *Logan County Gazette,* and was afterward editor of the *Western Law Journal.* He served in the lower house of the State legislature and for five years as State senator, and from 1857 to 1864 was judge of the Court of Common Pleas and of the District Court. After seeing some military service (1862), he was elected to Congress in 1865 and in 1880 appointed first Comptroller of the United States Treasury, from which office he retired in 1885. He has published several books on law, notably 'The Law of Claims against the Government' (1875), and 'The Treaty Question' (1871); 'Decisions of the First Comptroller in the Department of the Treasury of the United States' (1881–85).

LAWRENCE, William, American Protestant Episcopal bishop: b. Boston, 30 May 1850. He was graduated at Harvard in 1871, and at the Episcopal Theological School, Cambridge, Mass., in 1875; was rector of Grace Church, Lawrence, Mass., 1876–84; professor of homiletics and pastoral theology at the theological school above named, 1884–93; dean of the school, 1888–93. He was university preacher at Harvard, 1888–91. In October 1893 he was elected bishop of Massachusetts to succeed Bishop Brooks, and was consecrated to that office, which he continued to hold, in the following year. He has published a 'Life of Amos A. Lawrence,' his father (1889); 'Visions and Service' (1896); 'Life of Roger Wolcott' (1902); 'Study of Phillips Brooks' (1903), and other works.

LAWRENCE, William Beach, American jurist: b. New York, 23 Oct. 1800; d. there, 26 March 1881. He was graduated at Columbia College in 1818, and after his admission to the bar in 1823 he practised in New York, where he attained eminence. He removed to Newport, R. I., in 1850; was elected lieutenant-governor of Rhode Island in 1851 and soon after became acting governor. He became widely known by reason of his connection with the "Circassian case" in 1873, before the American and British International Court in Washington, D. C., his arguments securing the case for his clients and leading to the only reversal of a decision by the United States Supreme Court that had ever occurred. He published 'History of the Negotiations in Reference to the Eastern and Northeastern Boundaries of the United States' (1841); 'Belligerent and Sovereign Rights as Regards Neutrals During the War of Secession' (1873); 'Disabilities of American Women Married Abroad' (1871); 'Administration of Equity Jurisprudence' (1874); 'Etudes sur la jurisdiction consulaire et sur l'extradition' (1880).

LAWRENCE, Kan., city and county-seat of Douglas County, on both sides of the Kansas River, and on the Atchison, Topeka and Santa Fé and the Union Pacific railroads, 40 miles west of Kansas City. It is the farming trade centre for Douglas and parts of two other counties, and is principally engaged in manufacturing, which is greatly promoted by the excellent water power furnished by the river. It is the seat of the Kansas State University, Haskell Institute and Government Indian Industrial School; contains a hospital, public library, fine school buildings and several public parks, and has flour and paper mills, barbed-wire, ice, brick and tile, shirt, sash and door factories and foundry and machine shops. There are electric-light plants, waterworks, several national and State banks, daily, weekly and monthly periodicals and an assessed property valuation of over $1,000,000. The city was settled by an anti-slavery colony from the East in 1854 and was named in honor of Amos A. Lawrence. It was the first of the Kansas Free-State towns founded by the Emigrant Aid Society, soon after the passage of the Kansas-Nebraska bill (q.v.). In 1856 a band of Missouri border ruffians sacked the town, which was defended by old John Brown (q.v.) and his sons. In 1863, the Confederate raider Quantrell attacked the town and killed 125 citizens. The commission plan of city government has been in operation since 1914. Pop. 13,018.

LAWRENCE, Mass., city, and one of the county-seats of Essex County, on both sides of the Merrimac River, and on the Boston and Maine Railroad, 26 miles northwest of Boston. It is one of the notable and leading manufacturing cities in the valley of the Merrimac River. Built at the lowermost available rapid on the river, the city has the concentrated power of all the tributaries of that stream and receives benefit from the entire watershed feeding the main current — an area of 4,450 square miles. The water power developed at this point, amounting to about 15,000 horse power, is remarkably uniform and reliable.

Water Power Plant.—In 1845–48 the "Great Stone Dam" located at Bodwell's Falls near the old historic "Andover Bridge" was built of hammered granite. When finished this structure was considered the most complete and durable work of the kind then existing in America. It was bedded upon the underlying strata of bluestone or Merrimac schist and it was so thoroughly constructed that it has stood to this day without alteration or addition, seemingly a part of the ledges between and upon which it was built. This dam concentrated at one point the power of three successive natural river rapids, the accomplished result being a fall of 26 feet, increased in height, when needful, by flashboards, to 30 feet. The overfall of water is in one unbroken sheet over a crest, nearly straight in line, 900 feet in length between the granite abutments. In addition to this unbroken span of solid stonework the protecting wings of the dam are 729 feet in combined length. There are two main canals, one along the northern bank of the river, one mile in length, and another upon the southern side, one-half mile long; these distribute water power to the large mills and workshops. In 1915 a survey was made under the supervision of a commission appointed by the governor of the State for a navigable channel from the mouth of the river at Newburyport to Lowell, Mass., a distance of 36 miles. In 1917 the United States Board of Army Engineers reported favorably upon the survey, and in 1918 both branches of the Massachusetts legislature passed a bill authorizing the building of this navigable waterway in conjunction with the Federal government. Pending war induced the governor to veto the bill at that time, but it will in all probability be passed as soon as conditions warrant. Such action will make of Lawrence a direct seaport town. Steam and electric power are also used in addition by nearly all manufacturers and in some instances are exclusively relied upon.

Manufacturing and Business.— Lawrence may well be known to Americans as "The Worsted City," for the United States census returns show that in the production of worsted and woolen dress goods Lawrence leads the United States and is second in the world; Birmingham, England, being the only city which excels her in this respect. Lawrence leads the entire country in the amount of capital invested in any one locality in the worsted and woolen dress goods industry, and in the value of that class of goods produced, the sum invested in this distinct business in 1917 being $120,263,298 and the value of product $135-618,681. Among wool-growers and dealers of the world, the city is known as a leading consumer of that staple. Among the great manufacturing companies that lead in importance are the Pacific Mills, having over 10,000 employees; the American Woolen Company, employing 17,000 operatives; the Arlington Mills, with 8,500 operatives; the Everett Mills, employing 5,500. The total investment in the textile industry in Lawrence in 1917 was $175,534,916 and the total value of textile products was $174,495,698. Lawrence is also famous for its manufacture of calendered book paper. In the manufacture of wooden wheels Lawrence also leads the country, the Archibald Wheel Company manufacturing government artillery wheels, wheels for fire engines and automobile wheels.

The first steam fire-engine in America was manufactured in Lawrence. Paper-mill machinery is also extensively manufactured, as are also shoes, foundry products, carriages and steam fire apparatus, engines, boilers and mill fittings and findings of all description.

The industrial unrest which has been generally attributed to Lawrence is now the subject of systematic study by a commission of citizens employing a high-grade publicity expert, and seeking by co-operation with the heads of the industries to establish a new industrial consciousness and relationship between the workers and the employers. The means employed are to be along the lines of those advocated in the Rockefeller Industrial Plan of Shop Committees, Co-operative Management, ultimate partnership and ownership by such employees as fit themselves for it; an increase in home and property ownership as a stabilizer of labor and a means of reducing labor turnover; a development of parks, playgrounds and recreational centres; the increase in interest in education, Americanization and naturalization, and a broad comprehensive plan of housing and city planning.

Site and Environment.— The site was peculiarly adapted to the building of an important industrial centre. The small Spicket River here enters the Merrimac from the north and the Shawsheen stream enters from the south. The location is healthful. The rapid Merrimac River divides the city into nearly equal sections, the northern half now having the largest population and most important industrial establishments. The city was laid out in 1845–46 by the founders and promoters, and has been built largely in accordance with original plans.

Public Works and Buildings.— The waterworks, established in 1874–75, were so ample that extensions have not made it necessary to reconstruct the pumping plant or the storage reservoirs. The source of water supply is the Merrimac River. The filtration beds that cleanse the current before it is distributed for use were designed and constructed in 1892 under the care and approval of the Massachusetts State Board of Health. The experimental station of the Massachusetts State Board of Health is established here. Illuminating and heating gas and electric lighting and power are supplied by a single chartered company. The courthouse was erected in 1903, at a cost of $250,000, and the post office was erected at about the same time at a cost of $150,000. The school buildings are large and commodious. The old city hall, the original "Town House," served for a quarter century almost every conceivable public use and is still a noticeable structure. Other notable features are the Essex County Training School, Children's Home, Cottage and Lawrence hospitals. A noteworthy experiment is now being tried by the American Woolen Company at its Washington Mill, where an immense modern building has been erected, part of which is being devoted to the use of a day nursery where the mothers employed in the mill can bring their children mornings and leave them in charge of trained nurses.

Parks and Pleasure Grounds.— The founders of the city wisely reserved a common of 17 acres at the very centre of the business and residence section as a public pleasure ground. No buildings are allowed upon this central park and no public reserve in the commonwealth is more nobly wooded or more truly the people's ground. About this central park the largest public buildings, the leading Protestant churches and many of the best residences are grouped. Four large outlying parks in a nearly wild condition but of much natural beauty and several smaller squares are well cared for by an established park commission of five members. A playstead of several acres exclusively for games and athletic exhibitions is conveniently located.

Banks and Savings Institutions.—Lawrence has one national, three trusts, three savings, three co-operative and one Morris Plan bank, the total savings bank deposits being over $30,00,000, and the total bank deposits, savings and commercial, being over $56,000,000.

Churches and Charities.— There are over 40 organized churches in the community, the Roman Catholics having much greater numbers and larger value in property than any other denomination. There is an organized city mission. A General Emergency Hospital and Children's Home are maintained by the Ladies' Union Charitable Society, a protectory or asylum for orphans or destitute children, an endowed Home for Aged People, and every nationality in the community has its own relief, benefit or social societies.

Government, Schools, Free Libraries and Lectures.— Municipal control is vested in a commission of five, consisting of a mayor and four aldermen, each in charge of a department, namely, finance, public safety, public property and parks, engineering and public health and charities. The annual budget of expenditures for municipal maintenance and operation approaches $2,000,000. There are 32 public schools, one industrial school, 11 parochial schools and one training school which is maintained by the county. There is a high school and a recently constructed central grammar school of 36 rooms with the most modern equipment, including baths of all kinds, gymnasium, lunchrooms, lecture halls, meeting-rooms for parents and having trained nurse and doctor constantly in attendance. The evening schools are maintained as a part of the public school system and give courses in classical and English studies, also special instructions in penmanship, mechanical and freehand drawing, bookkeeping and typewriting and the natural sciences. A special feature in which Lawrence is very active is the course in Americanization and naturalization, which is being discussed and studied by educators throughout the country. A free course of lectures especially for industrial classes, upon scientific and miscellaneous subjects, has for many years been sustained by endowment. The free public library of over 50,000 volumes is patronized by all classes. The main library building was the gift of a generous citizen.

History.— Previous to 1845 the territory now included within city limits (about seven square miles lying in form nearly a square) was an unimportant section of two old, historic towns — Andover and Methuen. The inhabitants of the site numbered only about 350 and were nearly all the families of quiet farmers or river men; there was not a church building, warehouse for trade or manufacturing establishment of any importance then standing in the entire district. In 1845–46 an associated company of manufacturers, financiers and merchants, the leading pioneer manufacturers and progressive business men of prominence in Massachusetts, after critical examination, associated themselves together and procured an act of incorporation under the name of the Essex Company, chartered for the purpose of developing and controlling the water power and establishing factories and workshops at or near the site they selected. This company purchased lands covering nearly half the area of the contemplated town and secured land or flowage rights for several miles above the site chosen for the projected city. It was decided to locate at the lowermost of three successive Merrimac River rapids below Lowell, at the confluence of the Merrimac, Spicket and Shawsheen rivers. Promoted as the Lawrence building and manufacturing enterprise was at the outset by responsible and powerful sponsors, the «New City,» as it was at first called, rapidly developed and became almost at the beginning important as an industrial centre. In less than two years from the commencement of operations in 1845, the settlement was organized as a separate town, taking the name of Lawrence in honor of the eminent merchant manufacturers of that name who were so deeply interested in establishing the town and city. The city has had its calamities. Its industrial enterprises survived the financial reverses of 1857, 1858 and 1859, only because of powerful support given by loyal defenders and business leaders. This time of trial was succeeded by the gloom attendant upon the «Fall of Pemberton Mill,» 10 Jan. 1860, an occurrence that enlisted the interest and sympathy of the entire country. In the War of the Rebellion the city's volunteers were among the first to respond to the call for troops and were among the first to engage in conflict. A citizen, Sumner H. Needham, was the first martyr to fall in the ranks of the patriot soldiery in April 1861. Lawrence was incorporated as a city 10 May 1853.

Population.— The cosmopolitan character of the population is particularly noticeable. Forty-six nationalities are represented among the population. Formerly the greatest immigration was from France, the British Isles, Canada and Germany, but of recent years the flow has been from Italy, Greece, Poland, the Balkan States and Russia. Pop. 105,000.

George E. Rix,
Secretary of Lawrence Chamber of Commerce.

LAWRENCE UNIVERSITY, Appleton, Wis., a Methodist Episcopal institution founded in 1847 and named in honor of its principal donor, Amos A. Lawrence, of Boston. In 1916 it had 47 professors and instructors, 721 students, 34,129 volumes in the library, and productive funds, $905,876; grounds and buildings valued at $531,000; benefactions during 1915, $23,000; income, $112,280.

LAWRENCEBURG, lâ'rĕns-bĕrg, Ind., city and county-seat of Dearborn County, on the Ohio River, and on the Baltimore and Ohio and the Cleveland, Cincinnati, Chicago and Saint Louis railroads, 22 miles west of Cincinnati, Ohio. It was settled in 1817 and was first incorporated in 1847. The government is administered by a mayor, elected every four years, and by a city council, elected every two years. It has manufactures of flour, edge-tools, burial caskets, tube-well supplies, wagons, barrels, etc. Pop. 3,930.

LAWRENCEVILLE, Ill., town and county-seat of Lawrence County, 141 miles east of Saint Louis, on the Baltimore and Ohio Southwestern and on the Cleveland, Cincinnati, Chicago and Saint Louis railroads. The surrounding country is rich in oil deposits and agriculture is likewise important. The town has modern improvements and industrially is chiefly occupied in refining crude oil. Pop. 3,235.

LAWRENCEVILLE SCHOOL, The, an American college preparatory school at Lawrenceville, N. J., originally founded in 1810, but refounded in 1882 as an endowed school known as the «Lawrenceville School on the John C. Green Foundation,» at which time the English «house system» was adopted. In scope it corresponds to such English schools as Harrow or Rugby and now contains about 400 pupils with some 36 masters. There are 13 masters' houses, with an Upper House and the Hamill House for the boys of the upper form, managed by boards of directors appointed by the boys themselves. There are five forms, each corresponding to one year's work. In addition to the buildings already named there are a large stone chapel, a spacious building for classroom exercises called Memorial Hall, and an immense gymnasium with swimming pool, erected in 1902. Lawrenceville itself is a small village six miles northeast from Trenton and five miles from Princeton, southwest.

LAWS, Direct Enactment of. See Initiative; Legislation, Direct; Referendum.

LAWS, Execution of. See Executive.

LAWS OF NATURE IN MYTHS. See Mythology.

LAWS AND USAGES OF WAR, a branch of public, international law covering the body of rules and principles instituted and observed by civilized nations in the conduct of a public war. The code covers the relations of neutrals and belligerents, blockades, captures, prizes, truces, armistices, capitulation, prisoners, declarations of war and peace, and all matters in any way connected with the prosecution of war. Custom and the demands of advancing civilization form the basis of many of the statutes, while others have been formulated and agreed to by international conventions. Consult 'Rules of Land Warfare' (Washington, Government Printing Office, 1914).

LAWS OF WAR, The. A comparison of the laws of war as they exist to-day with those which governed the conduct of belligerents 100 years ago will reveal one striking difference, namely, whereas, the law to-day is in large part written, a century ago it was for the most part unwritten. Aside from occasional stipulations in treaties dealing with such matters as the treatment of enemy subjects at the outbreak of war, the exercise of the right of search and capture, what goods should be treated as contraband and the like, the law of war consisted mainly of custom and usage, the evidence of which was found in the treatises of text writers and in the decisions of prize courts. Naturally, the text writers and jurists were not always in agreement as to what custom and usage permitted and what it forbade and even where there was agreement the recognized rules were not always known to military or naval commanders.

During the past 50 years out of this mass of custom and tradition a large body of written law has developed, the greater part of which is now embodied in the texts of international conventions and declarations which have received the formal assent of the great body of states, and in official manuals or ordinances issued by states for the information and guidance of their military and naval commanders. What may be regarded as the starting point in the process by which the law of war has thus far been reduced to written form was the promulgation by Presiden Lincoln in 1863 of General Orders No. 100 entitled, «Instructions for the Government of the Armies of the United States in the Field.» In the main, these «instructions» were prepared by Dr. Francis Lieber, a distinguished publicist of German origin, who in early life emigrated to the United States and was for many years a professor in South Carolina College. The code prepared by him consisted of 157 articles which defined the limits of military authority and presented in more or less detail the rights and duties of military commanders in time of war. The effect was to limit the arbitrary powers of commanders and to remove the excuse for violations of the law of nations on account of their ignorance as to what custom and usage required or uncertainty as to its meaning. The promulgation of these «instructions» represented the first attempt ever made by a government to define and embody in a written code the laws of land warfare. They received high praise from the great jurists of the time, they formed the basis of the regulations adopted by the Brussels Conference in 1874 and they unquestionably exerted great influence upon the subsequent development of the laws of war. They remained in force until 1914 when they were superseded by a new manual entitled the 'Rules of Land Warfare,' which are largely a revision of Lieber's code. What was vital and important in Lieber's code was retained, what was obsolete was omitted and the provisions of the new manual were brought into harmony with the great international conventions adopted at Geneva and The Hague.

A few other governments followed the example of the United States, and in 1899 the first Hague Conference impressed by the desirability of each state having a code of this kind inserted in its convention respecting the laws and customs of war on land an article making it the duty of the contracting parties to issue instructions to their armed forces, which instructions should be in conformity with the regulations annexed to the Convention. The British government had already as early as 1884 issued a manual of military law and this manual was now reissued and brought into harmony with the rules of the Hague Convention. The governments of most other countries have done likewise. In 1902 the German government issued a manual of the laws of war entitled, 'Kriegsbrauch im Landkriege' prepared by the Great General Staff. This manual has been much criticized not only because of the extreme views set forth by its authors in regard to the rights of belligerents, military necessity, the means that may be employed in the conduct of war, etc., but because it ignores many important provisions of the Hague Convention, to which such manuals are required to conform, repudiates outright some of them and dismisses others still with the statement that they are good enough in theory but that they will never be observed in practice by belligerents. In this respect it forms a striking contrast to those of the United States, Great Britain and France, the provisions of which conform in every essential particular to the regulations annexed to the Hague Convention.

Although the Hague Convention did not make it the duty of the contracting parties to issue manuals for the guidance and information of their naval commanders in the conduct of maritime warfare a number of governments have in fact done so. Thus Great Britain has her manual of Naval Prize Law, Germany her prize code (promulgated 3 Aug. 1914), which it may be added is not open to the criticism which has been so frequently directed against the German manual of land warfare, and France her «instructions» to the commanders of the naval forces, first issued 19 Dec. 1912, and reissued in revised form 30 Jan. 1916. In 1900 a naval code prepared by Admiral Stockton was promulgated by the Navy Department of the United States but it was withdrawn by President Roosevelt in 1905 and has not been reissued or replaced by another.

The practice of governments of issuing manuals for the information and guidance of their military and naval commanders marked an important step in the development of the laws of war. The effect was to define and reduce to written form many of the customs and usages governing the conduct of war on sea and land and thereby remove or reduce the possibility of harm which might result from ignorance or uncertainty on the part of commanders as to what was permissible and what was forbidden by them.

The capital defect of these manuals, however, lay in the fact that being unilateral acts they were binding only upon the commanders and troops of the government which issued them and might be altered or revoked at any time. In short, they had no international binding effect. What was needed to complete the process of development of which they were the starting point was an international code containing an authoritative definition and statement of the laws of war formulated and adopted by the whole body of states, which therefore would be binding upon all of them and which could not be altered at the will of any single state.

So far as the law of land warfare is concerned this need has now been met in a large degree and to a less extent it may also be said of the law of maritime warfare. This change has been brought about by the adoption of a number of international conventions and declarations, through the agency of conferences representing in some cases practically the whole body of states. These acts are the Declarations of Paris of 1856 and of Saint Petersburg of 1868, the Geneva Conventions of 1864 and 1906 and the Declarations and Conventions of the two Hague Conferences of 1899 and 1907.

The Declaration of Paris of 1856 represented the first attempt to embody in an international act certain rules regarding maritime warfare. It declared privateering to be abolished, established the immunity of private property, except contraband, from capture at sea, when found under a neutral flag and proclaimed that a blockade to be legal must be effective, that is, it must be maintained by a sufficient number of vessels to make the violation of the blockade hazardous to any ship which should undertake to pass the blockading cordon.

The declaration was framed by representatives of Austria, France, Great Britain, Prussia, Russia, Sardinia and Turkey. At the outbreak of the War of 1914 the only maritime powers which had not formally ratified or adhered to the declaration were the United States, Spain, Mexico, Venezuela, Bolivia and Uruguay. In practice the United States and Spain acted in accord with its rules during the Spanish-American War of 1898 and at the second Hague Conference in 1907 the delegations of Mexico and Spain declared that their governments accepted the declaration in entirety. Its rules may therefore be now regarded as a part of the body of international law governing the conduct of maritime warfare.

Eight years after the adoption of the Declaration of Paris, that is, 1864, a conference representing 16 states met at Geneva and framed the first Red Cross Convention, the general purpose of which was to create certain immunities for the persons who are charged with the care of sick and wounded soldiers in war and for the hospitals, ambulances and material employed in such service. Within a period of four years nearly all the governments of Europe and America had become parties to the convention. In 1906 it was revised and improved by a second conference which also met at Geneva.

In the meantime, 1868, the Declaration of Saint Petersburg was framed by a conference representing most of the governments of Europe. The parties to the declaration engaged to refrain from using a certain type of bullet which by reason of character inflicted superfluous injury upon those against whom it was employed. The declaration also affirmed the humanitarian principle that there are limits at which war ought to yield to the requirements of humanity, asserted that the only legitimate object which states should endeavor to accomplish during war is to weaken the military forces of the enemy and declared that this object would be exceeded by the employment of arms which needlessly aggravate the sufferings of disabled men or render their death inevitable. The principle thus laid down, although criticized by some militarists like von Moltke, has been affirmed by the military manuals of many countries, and was incorporated by reference in article 23 of the Hague Convention respecting the laws and customs of war.

The success of these efforts to reach an agreement as to certain rules and principles governing the objects and methods of war paved the way for further international legislation. In 1874 a conference representing most of the European powers met at Brussels and framed a body of rules governing the conduct of war on land but unfortunately it was not ratified by the powers and therefore remained without international force. Nevertheless its rules exerted a strong moral influence upon the conduct of the wars which followed, and many of them found their way into the military manuals issued by various governments for the guidance of commanders and troops in the field. Moreover it became the basis of the Hague Convention of 1899 respecting the laws and customs of war on land.

The high water mark in the movement to define and codify the laws and customs of war was reached in the work of the two Hague Conferences of 1899 and 1907. The first conference formulated and adopted three conventions and three declarations, five of which deal with the conduct of war, the most important of them being the convention respecting the laws and customs of war on land. The latter convention was ratified by the governments of all the states represented at the conference and was later adhered to by the governments of 19 other states not represented at the conference. The conference of 1907 went much further and adopted 13 conventions and one declaration, 10 of which relate directly or indirectly to the conduct of war. (See HAGUE CONVENTIONS). The most important of them was the convention respecting the laws and customs of war on land, which was mainly a revision of the corresponding convention of 1899.

In consequence of a clause which declared that the convention should be applicable only between the contracting parties, and then only if all the belligerents were parties, this convention as well as most of the others of 1907 was not legally binding during the recent European War, because several of the belligerents have never ratified it. Nevertheless, the Convention of 1899 respecting the laws of war on land is binding upon all because all the belligerents were parties to it. Moreover, it is well to remember that many of the provisions of the conventions of 1907 were not new rules but were merely declaratory of the existing customary law and as such they were binding independently of the status of the conventions in which they are incorporated — as much so as any other well-established customary rule of the law of nations. In some cases belligerent governments during the recent war took advantage of the circumstances that the conventions of 1907 were not technically binding, in order to avoid the obligations which the conventions created, but for the most part they proceeded on the theory that they were in fact binding and the governments of several of them announced at the outbreak of the war that they would observe their provisions provided their adversaries would do likewise.

The Hague Conventions, so far as they relate to the conduct of war, deal mainly with war on land; nevertheless several conventions were adopted relating to maritime war. Thus there was a convention relative to the conversion of merchant vessels into warships, a convention relative to the laying of submarine mines, a convention governing naval bombardments and a convention relative to certain restrictions upon the right of capture in naval warfare. The questions of blockade, contraband, visit and search, transfers of flag, destruction of prizes and others, however, were not dealt with by the Hague conventions. It thus happened, therefore, that a large part of the law of maritime warfare remained unwritten and in the form of custom. As there were wide divergencies of opinion and practice in regard to some of these matters it was of the highest importance that a general agreement should be reached in these points and the results embodied in an international convention. In consequence of the action of the Second Hague Conference in providing for the creation of an international prize court which should apply the "rules of international law" in the decision of the cases brought before it, the necessity for agreement among the maritime powers as to what the rules of international law were, so far as they related to naval warfare, was evident. Upon the initiative of the British government, therefore, a conference representing the principal maritime powers was called to meet at London in December 1909 and it agreed upon a body of rules relating to the unsettled questions of maritime warfare mentioned above and embodied them in an act known as the Declaration of London. Unfortunately, however, when the great war broke out in Europe in 1914 none of the signatory powers had ratified the declaration. The American government thereupon proposed to the several belligerents that they agree to accept the declaration as a temporary code and conduct their naval operations in accordance with its rules, notwithstanding that it had not been formally ratified by any of them. The governments of Germany and Austria-Hungary signified their willingness to do this provided their adversaries would do so. In consequence, however, of the action of the British and French governments in putting the declaration into effect with important modifications, this on the face of the terms of the declaration that it should be ratified as a whole and not by piecemeal, the American government withdrew its proposal and announced that in upholding its own rights it would rely upon the existing law of nations rather than upon the declaration.

In July 1916 the British and French governments, partly in consequence of Germany's methods of submarine warfare and partly in consequence of changed conditions, revoked the earlier proclamations by which they had put the declaration into force with certain modifications and promulgated a series of new rules which they would apply in respect to contraband, continuous voyage, etc. While the declaration as such was thus thrown overboard, it may be said of it what has been said above of the Hague conventions, of 1907, namely, that many of its rules were not new but were merely declaratory of the existing customary laws and as such were binding upon the belligerents as much so as if the declaration had been formally ratified.

At the present time, therefore, only a comparatively small part of the law of maritime warfare is to be found in the texts of international conventions; like the law of land warfare a century ago, it still consists largely of custom and of judicial precedent. Owing to the fact, however, that it has been the object of interpretation by prize courts for more than a century, it is now fairly well defined although as stated above there are still divergencies of opinion and of practice in regard to some important questions. While the larger part of the law of land warfare is now written and may be found in the texts of the great international conventions, there are still many questions, reprisals, for example, that are unregulated, except by custom and usage. Both of the Hague conferences admitted that it had not been possible to agree upon regulations concerning all cases which might arise in practice and they took the precaution to declare expressly in the preamble to the convention respecting the laws and customs of war on land that the high contracting parties did not intend that unforeseen cases should, in the absence of a written undertaking, be left to the arbitrary judgment of military commanders and in "cases not included in the regulations adopted by them, the inhabitants and the belligerents remain under the protection and the rule of the principles of the law of nations as they result from the usages established among civilized peoples, from the laws of humanity and the dictates of the public conscience."

The European War has shown that some of the established rules of war law, those relating to blockade and contraband, for example, are not in harmony with present day conditions and will need to be revised; others are obsolete and many new rules will be necessary in consequence of the invention of new instrumentalities for carrying on war. As to the exact changes that will be made in the new rules adopted it would, of course, be idle to speculate. See INTERNATIONAL LAW.

Bibliography.— Bentwich, 'The Declaration of London'; Holland, T. E., 'Laws of War on Land' (Introductory chapter); Speight, 'War Rights on Land' (Chap. I); Renault, 'War and the Law of Nations' (*American Journal of International Law*, Vol. IX, p. 1); 'Rules of Land Warfare' (Washington, Government Printing Office, 1914); 'British Manual of Military Law›; Morgan, J. H., ‹The War Book of the German General Staff› (New York and London 1915).

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LAWSON, Andrew Cowper, American geologist: b. Ansruther, Scotland, 25 July 1861. He was graduated at the University of Toronto in 1883, took his A.M. there in 1885 and his Ph.D. at Johns Hopkins in 1888. He served on the Geological Survey of Canada in 1882–90, afterward becoming professor of mineralogy and geology at the University of California, where he is now dean of the College of Mining. He was a delegate to the Geological congresses at London 1888, Saint Petersburg 1897 and Toronto 1913; and served as chairman of the California Earthquake Investigation Committee in 1906. He is a member of various scientific societies and in 1909–10 he was president of the Seismological Society of America. Author of numerous papers on geology.

LAWSON, Cecil Gordon, English painter: b. Wellington, Shropshire, 3 Dec. 1851; d. London, 10 June 1882. He exhibited at the Academy in 1870, but many of his pictures were rejected by the hanging committee till 1878, when his ‹Minister's Garden› and a ‹Pastoral› at the Grosvenor made him famous. He was highly esteemed by the poet-painter, Rossetti, and his works are now much valued. Consult Gosse, ‹Cecil Lawson: A Memoir.›

LAWSON, Ernest, American landscape painter: b. Halifax, Nova Scotia, 1873. He studied art at the Art Students' League in New York under Twachtman and James Alden Weir and spent 1903–04 in study in France. He is of the Impressionist school in its best development and is especially happy in his rendering of both urban and rural scenes, confining his work chiefly to American subjects until 1916 when he spent a season painting in Spain. He was awarded the silver medal at the Saint Louis Exposition in 1904, the Sesnan medal of the Pennsylvania Academy in 1907, the first Halgarten prize in 1908, the Altman prize in 1916, the gold medal at the San Francisco Exposition in 1915, the Corcoran silver medal in 1916 and the Inness gold medal in 1917. He was elected an associate of the National Academy in 1908. Among his paintings are ‹Near High Bridge›; ‹The Abandoned Farm› (National Gallery, Washington); ‹Road Down the Palisades› (1911); ‹Hillside at Inwood› (1912); ‹Evening, Palisades› (1913).

LAWSON, Henry Archibald, Australian poet, novelist and short story writer: b. Grenfell, New South Wales, 1867. He worked on his father's farm, with the exception of some time spent in Sydney learning carriage-painting, until he was 20 years of age, when he went to Melbourne and two years later to Albany, Western Australia. There he worked as a house painter. While in Sydney he began contributing poems and stories to the *Bulletin* and this he continued long after he had left the city. So successful were these efforts that he secured a position on the literary staff of *The Boomerang*, Brisbane (1890–91). For the next five years he wandered about Australia, sometimes working at this trade, at others doing any kind of work that came to hand. In 1897 he was a government teacher in New Zealand. Three years later he was in London. After three years' residence in England he returned to Sydney in 1902. There he continued at his trade and began working up more of his experiences into poems, sketches and short stories, which have about them a freedom, naturalness, boldness and sureness of touch that often suggests Kipling. Among his published works which are all provincial, and for that reason the more interesting, are ‹Short Stories in Prose and Verse› (1895); ‹In the Days When the World was Wide› (1896); ‹While the Billy Boils› (1896); ‹Verses Popular and Humorous› (1900); ‹The Country I Came from› (1901); ‹Joe Wilson and his Mates› (1901); ‹Children of the Bush› (1902); ‹On the Track and over the Sliprails› (1905); ‹When I was King and Other Stories›; ‹Star of Australia.›

LAWSON, John, American colonial surveyor-general: d. 1712. He was of Scotch birth; began his surveys in 1700, and was an intelligent observer, enterprising and circumspect, but fell a victim to the jealousy of the natives, who confounded the surveyor of their territory with those who despoiled them of it. He was captured by them during one of his explorations when in company with De Graffenried, a Swiss baron who contemplated colonization. The latter was permitted to buy himself free, but Lawson failed to propitiate their hostility and perished by the fire torture. He left one of the most valuable of the early histories of the Carolinas, of their feeble condition, their resources and aspects and their principal aboriginal tribes. It is entitled ‹A New Voyage to Carolina, containing the Exact Description and Natural History of that Country, together with the Present State thereof; and a Journal of a Thousand Miles Traveled through Several Nations of Indians, giving a Particular Account of their Customs, Manners, etc.› (1709). The volume is a quarto of 258 pages, well illustrated with one of the best maps of the time, and with various other engravings, chiefly in natural history. It is now rare.

LAWSON, Thomas William, American banker and author: b. Charlestown, Mass., 26 Feb. 1857. He was educated in the public schools and in 1870 established himself as a banker and broker in Boston. He operated extensively in copper properties and was known as a particularly daring speculator. He became senior member of the firm Lawson, Arnold and Company, president of the Bay State Gas Company of Delaware, The Thomas W. Lawson Company, the Trinity Copper Company and the First National Copper Company. He is a prominent yachtsman and in 1904–05 he attracted wide attention by his contribution to *Everybody's Magazine* of a series of articles, ‹Frenzied Finance,› supposed to be an exposé of the evils of speculation in copper, oil and stocks generally. Lawson's high financial standing and his reputation for daring on the exchanges enhanced the sensational qualities of the attacks. Author of ‹The Krank› (1887); ‹History of the Republican Party› (1888); ‹Secrets of Success› (1888); ‹Collection of Poems and Short Stories from Magazines› (1888); ‹Lawson's History of the American Cup› (for private distribution, 1902); ‹Frenzied Finance' (1905); 'Friday the Thirteenth' (1907); 'The High Cost of Living' (1913).

LAWSON, Victor Fremont, American newspaper publisher: b. Chicago, 9 Sept. 1850. He was educated at Phillips Academy, Andover, Mass. He inherited from his father an interest in a printing establishment, and in 1876 bought the Chicago *Daily News*, which, with his partner, Melville E. Stone, he developed successfully, starting a morning edition in 1881 under the name of the *Record*. In 1888 he bought out his partner and became sole proprietor; in 1901 the *Record* was merged with the *Times-Herald* under the name of the *Record-Herald* and with the *Inter-Ocean* under the name of the Chicago *Herald* in 1914. He has been president of the Associated Press; has also been active in philanthropic work, and was active in support of the movement for a United States Postal Savings Bank, and started the *Daily News* Fresh Air Fund, which supports a sanitarium for sick children of the poor.

LAWSON, Sir Wilfrid, English statesman: b. Cumberland, England, 4 Sept. 1829; d. London, 1 July 1906. He early came into notice as a temperance advocate. In 1859 he was elected to Parliament for Carlisle, in which, with brief intervals, he sat for 47 years. In 1863 he introduced his first permissive or local option resolution for the regulation of the liquor traffic, and in 1864 brought in a bill on similar lines. From 1868-85 he again represented Carlisle; from 1886-1900 the Cockermouth Division of Cumberland, and from 1903 till 1906 the Camborne division of Cornwall, and was again returned for his old constituency in 1906. He may be said to have devoted his life to the temperance cause, and was president of the United Kingdom Alliance. His local option resolution was an annual event in the House of Commons, and passed in 1880, 1881 and 1883. A strong Radical in politics, a devout churchman and a keen sportsman,— he was master of the Cumberland hunt — he was a brilliant platform speaker, whose humor was only the mask of a consuming earnestness of purpose. He was exceedingly popular in the House, and used to while away the tedium of the lobbies by snatches of impromptu verse. Three volumes of his speeches have been published and he is joint author with Sir F. C. Gould of 'Cartoons in Rhyme and Line' (London 1905).

LAWSON'S CYPRESS. See CYPRESS.

LAWTON, Henry Ware, American soldier: b. Manhattan, Ohio, 17 March 1843; d. San Mateo, Luzon, 19 Dec. 1899. He entered the military service as a private 16 April 1861; became captain 17 May 1862. He was mustered out 25 Nov. 1865, but entered the regular army as second lieutenant the next year; was transferred to the Fourth cavalry in 1871; and promoted to captain 20 March 1879. In 1876 he was conspicuous in the expedition against the hostile Sioux, took part against the Ute Indians in Colorado, in October 1879, and in the spring of 1886 was selected by General Miles to lead a picked body of troops into Mexico in pursuit of Geronimo. At the end of three months Geronimo and his band were captured. At the beginning of the Spanish-American War Lawton was a lieutenant-colonel, and was made a major-general of volunteers 8 July 1898. He was in command of the Second Division of the Fifth army corps before Santiago, and at the close of the war was transferred to the Philippines where he began active operations against the insurgents and after capturing Santa Cruz, a Filipino stronghold, 10 April 1899, and San Isidro, 15 May, was placed in command of Manila, 1 June. In the autumn he began an offensive campaign looking toward the capture of Aguinaldo, and was killed in the battle of San Mateo.

LAWTON, William Cranston, American educator and author: b. New Bedford, Mass., 22 May 1853. He was graduated from Harvard in 1873 and later studied at the University of Berlin. He was a member of the Assos expedition in 1881; in 1895-1907 he was professor of Greek language and literature at Adelphi College, Brooklyn, and he was afterward professor of literature at Hobart College, Geneva, N. Y. He was secretary of the Archæological Institute of America in 1890-94. He has contributed extensively to magazines and was classical editor and contributor to 'Warner's Library of the World's Best Literature'; author of 'Three Dramas of Euripides' (1889); 'Folia Dispersa' (verse); 'Art and Humanity in Homer' (1896); 'New England Poets' (1898); 'Successors of Homer' (1898); 'Pope's Homer' (1900); 'Histories of Greek and Latin Literature' (1903); 'Ideals in Greek Literature' (1905), etc.

LAWTON, Okla., city and county-seat of Comanche County, one of the three counties formed from the Comanche reservation and added to Oklahoma Territory 6 Aug. 1901. It is situated on the Chicago, Rock Island and Pacific and the Saint Louis and San Francisco railroads, about 90 miles southwest of Oklahoma City. Its principal industries are agricultural (especially cotton-growing) and the manufacture of cottonseed-oil. The local water supply is owned by the city; an extensive irrigation system in the neighborhood has been instituted by the government. Among the interesting features are Fort Sill, United States military post, the Wichita National Forest and Game Preserve, «Medicine Park» and the Fort Sill Indian School. The city was named in honor of Gen. Henry W. Lawton (q.v.), a very able American officer who lost his life in the war in the Philippines. Pop. 7,788.

LAWYER. See ATTORNEY; COUNSELLOR AT LAW.

LAWYER, common name given locally to certain fishes of different parts of the United States. They are the burbot, sometimes called also «lake lawyer»; the mudfish or bowfin; the stilt sandpiper and the mangrove snapper.

LAWYER, Rights and Duties of. See COUNSELLOR AT LAW.

LAXATIVE, a term applied to medicines and articles of food which without causing irritation evacuate the contents of the intestines. The terms aperients, lenitives and eccoproctics are also employed to cover the same meaning. Laxative articles of food, the use of which causes daily intestinal evacuations, contain considerable quantities of indigestible matter; some of them salts and acids which act in much the same way as the saline laxatives, and others, notably fruits and vegetables containing quantities of cellulose, which is indigestible in the main, by increasing the bulk of the fæces distends the intestines and induces easy evacuation. Among the laxative fruits are prunes, figs, pears, apples, oranges, peaches and berries. The laxative foods consist of the unboiled meal of cereal grains, such as graham or whole wheat flour, cracked wheat, oatmeal and Indian meal and pure bran. Honey, molasses and brown sugar are likewise usually effective in promoting a daily intestinal evacuation, and in some cases a glass or two of cool water taken immediately after arising will produce the same result. Laxative foods generally increase the appetite, due to the incomplete digestion of considerable nutritive matter caused by its mixture with cellulose or woody fibre. As a rule, the articles of food most easily assimilable result in constipation unless mixed with the bulky foods which are never wholly digested. Laxative medicines are called into use when a laxative diet has failed to produce the desired result, or when its use is inadvisable and when other hygienic measures are ineffective or cannot be employed. They include manna, tamarindus, magnesia, salts, sulphur, castor-oil, rhubarb, senna, cascara sagrada, phenolphthalein and the preparations of liquid paraffine. The use of liquid paraffine, promoted by Sir Arbuthnot Lane, has the effect of softening and rendering more bulky the contents of the intestines, thereby producing gentle evacuation without the paraffine's exerting other medicinal effect. The liquid paraffine is variously known as liquid albolene, liquid vaseline, Russian mineral oil, and there are many variations of the product under proprietary control.

LAXENBURG, Lower Austria, village nine miles south of Vienna, on the Schwechat River. Its palace is one of the summer homes of the Austrian imperial family. The Imperial Park, which is open to the public, consists of 1,000 acres, covers 17 islands in the Schwechat River and was laid out in 1782–98, following the English style. The Altes Schloss is used as a hunting lodge and was rebuilt in 1693 after its destruction by the Turks. The Neues Schloss dates from 1752 in the reign of Maria Theresa and Joseph II. The Franzenburg dates from 1799 and is noted for its art collections. Pop. about 1,000.

LAY, Benjamin, British-American philanthropist: b. Colchester, England, 1677; d. Abington, Pa., 3 Feb. 1759. His parents were Quakers, and he illustrated in his life the humane principles which the Society of Friends has so long conspicuously represented. At 18 he adopted a sailor's life, and for some years followed the sea. In 1710 he was married and lived again for a while at Colchester; afterward went to Barbadoes, where he became a merchant; but having aroused hostility by his denunciation of slavery, removed from the island (1718) to Philadelphia, where his anti-slavery agitation was continued. Of numerous tracts which he wrote on slavery one was published by Franklin, entitled 'All Slave Keepers, that Keep the Innocent in Bondage, Apostates' (1737). He was influential in bringing the Friends in this country to take a more decided stand against slave-holding, and just before his death a resolution was passed condemning those who still held slaves. He did not, however, confine his reforming endeavors to one direction, but labored for a more humane treatment of criminals, and discouraged the use of animal products whether for food or clothing, the use of tea and tobacco, and on one occasion tried to fast for 40 days in imitation of Christ. He is described as a singular figure, dwarfish and hunchbacked, and presenting an appearance of poverty. He was buried in the Friends' burying-ground at Abington.

LAY, Henry Champlin, American Protestant Episcopal bishop: b. Richmond, Va., 6 Dec. 1823; d. Easton, Md., 17 Sept. 1885. He was graduated at the University of Virginia, ordained deacon (1846) and priest (1848). He was consecrated missionary bishop of the Southwest (1859) and translated to the diocese of Easton (1869). During the Civil War the episcopal charge of Kansas was assigned to him, that State being then erected into a diocese. The revision of the lectionary was largely due to Bishop Lay; while he was engaged on the Standard Prayer Book up to his death. He was the author of 'Studies in the Church' (1872) and 'The Church and the Nation' (1885).

LAY, John Louis, American inventor: b. Buffalo, N. Y., 14 Jan. 1832; d. New York, April 1899. In July 1862 he was appointed second assistant engineer in the United States navy, and in 1864 invented a new torpedo. By means of this apparatus Cushing destroyed the *Albemarle*, a Confederate ram. When Admiral Porter advanced up the James River after the evacuation of Richmond, Lay was employed to clear away the submarine obstructions. He was engaged by the Peruvian government to mine the harbor of Callao, in view of a Spanish attack, but his main work as an engineer and inventor was the construction of the dirigible torpedo, which bears his name, and was purchased by the United States government.

LAY DAYS, maritime law term designating the stipulated number of days granted to the charterer of a vessel for shipping or unloading cargo, during which time no charge may be made for wharfage. The sum charged for days in excess of the number allowed in the charter is called demurrage and its amount is usually fixed in the charter. The period of lay days begins at the arrival of the vessel in port, and, in the absence of custom or agreement to the contrary, includes Sundays. In maritime insurance lay days also designate a period, commonly limited to 30 days, for which rebate of insurance may be demanded while a ship has remained idle and without fires at a dock.

LAY READER, a layman authorized by the bishop in Anglican and Episcopal churches to read certain portions of the service, certain approved sermons and to conduct funeral services. Lay readers were first appointed under Edward VI in 1560, and the order continued in England until the 18th century. It was revived in the United States because the limited numbers of the clergy made it impossible to compass the expansion of the missions, and in many places services were for years conducted solely by lay readers. These are appointed by the bishop and receive a license for one year, their powers being very particularly defined by the canons. In England the office was revived in 1866, and in 1905 the regulations concerning its scope were revised. Consult Hotchkin, S. F., 'Importance and Usefulness of Lay Reading' (1892); Restarich, H. B., 'Lay Readers' (1894).

LAYA, lą'yą, **Jean Louis,** French dramatist: b. Paris, 4 Dec. 1761; d. there, 25 Aug. 1833. He had written several comedies and tragedies before the production in 1793 of his 'L'Ami des lois' at the Theatre François. The play embodied a highly courageous protest against mob rule, daring to characterize Robespierre and Murat with scarcely a pretense of disguise only 19 days before the execution of Louis XVI. Prohibited by the Commune, but demanded by the populace, the play was produced after an appeal to the Convention, 30,000 Parisians guarding the theatre. Laya escaped from Paris and remained away until the end of the Terror, but a number of persons convicted of having copies of the play in their possession were guillotined. He was appointed to the Paris chair of literary history and French poetry in 1813, and in 1817 was elected to the Academy. His work is notable chiefly for its unusual influence at the time of its production. Author of 'Essai de deux amis' (1786); 'Voltaire aux Français' (1789); 'Les Dangers de l'opinion' (1790); 'Jean Calas' (1790); 'L'Ami des lois' (1793); 'Critique litteraire et politique' (1793); 'Les deux Stuarts' (1797); 'Falkland' (1799), etc.

LAYAMON, lā'yą-mŏn, or **LAWEMAN,** lâ'mąn, British chronicler. He lived early in the 13th century, and was a priest ministering at Radstone, now known as Areley Regis, on the Severn, in Worcestershire. He is the author of a metrical romance, 'The Brut,' which is mainly an amplified version of the French 'Roman de Brut' (q.v.), the latter being itself a compilation with additions from Geoffrey of Monmouth's 'Historia Britonum.' As history or literature its value is slight, but it is of high philological importance, and exhibits the English language in its period of transition and before it had become Gallicized, as in the 'Canterbury Tales' of Chaucer. In fact, there are not more than 90 words derived from the French in the whole poem of 56,000 lines. Consult the London Society of Antiquaries edition of 'Brut,' edited by Sir Frederick Madden (1847); Ten Brink, 'Early English Literature' (Vol. I, trans. New York 1883).

LAYARD, lā'ärd, **Sir Austen Henry,** English traveler and archæologist: b. Paris, 5 March 1817; d. London, 5 July 1894. He was of a family originally French; was partly educated in Italy; began to study law, but gave up this work and entered upon a course of travels in the East. Before he was 23 he had traveled in most of the larger European countries; in 1840 he was on the banks of the Tigris, and before the end of his career had "won distinction as a traveler, archæologist, politician, diplomatist and student of the fine arts." In 1845 he began the excavations in Assyria (q.v.) for which he first became celebrated. The results of his discoveries on the site of Nineveh (q.v.) were published in 1849–53. In 1849 he was appointed attaché to the British embassy at Constantinople. At first he paid his own expenses in his researches, but afterward received generous assistance from Lord Stratford de Redcliffe, then English Ambassador in Constantinople, and still later £3,000 voted by the House of Commons was used by the trustees of the British Museum for continuing Layard's excavations. In 1852 he entered Parliament as a Liberal, and became Under-Secretary of State for Foreign Affairs 1860–66. He was lord rector of the University of Aberdeen, 1855–56. In 1868 he was appointed chief commissioner of works and privy councillor; went to Spain in 1869 as British Ambassador, and 1877–80 was Ambassador to the Ottoman Porte. In 1878 he was created K.C.B., and was made a foreign member of the Institute of France in 1890. He wrote much on the history of painting, was a leading spirit in the Arundel Society and a trustee of the National Gallery. His writings include 'Nineveh and Its Remains' (1849); 'Nineveh and Babylon' (1853); 'Monuments of Nineveh' (1849–53); 'Inscriptions in the Cuneiform Character from the Assyrian Monuments' (1851); 'Early Adventures in Persia, Susiana and Babylonia' (1887, 1894). Consult his 'Autobiography' (1902).

LAYCOCK, lā'kŏk, **Thomas,** English physiologist: b. Wetherby, Yorkshire, England, 10 Aug. 1812; d. Edinburgh, Scotland, 21 Sept. 1876. He was the earliest to put forth the theory of the reflex action of the brain. This was in 1844, and in 1855 he became professor of the practice of physic and of clinical medicine at Edinburgh University. He published 'Mind and Brain' (1860); 'Methods of Medical Observation' (1856), etc., and wrote many professional papers on sanitary science, insanity, etc.

LAYERING, in horticulture, is a mode of propagating plants by bending down a young branch and covering part of it with earth, thus causing it to shoot forth roots before it is separated from the parent stalk. The portion covered with soil has often a notch cut in it below, or a tight ligature is applied. The free return of the sap is thus prevented, and the formation of roots from buds is promoted. The time which must elapse between the cutting or binding of the shoot and its separation from the parent plant varies greatly, a few months sufficing in some cases, while two years are requisite in others. This mode of propagation is employed for pinks, hortensias, heaths, gooseberries, etc.

LAYMAN'S MISSIONARY MOVEMENT, a movement which grew out of a missionary prayer meeting held in the chapel of the Fifth Avenue Presbyterian Church in New York 15 Nov. 1906, planned to commemorate the centennial of the famous Haystack Prayer-meeting held at Williamstown, Mass., from which the modern missionary movement received its impetus. The movement is not a society for missionary work, but is an interdenominational movement designed to aid the denominational boards already in existence. The object is two-fold: the education of the people so that there shall be a general understanding of missionary methods, plans and needs, and second, the examination of the foreign mission work in the field by commissions of laymen who pay their own traveling expenses. The movement has been recognized by most of the churches. In the first stages of its work banquets and get-together meetings were held in all the large cities of the United States and Canada. Later great conventions of laymen have been held within denominational lines, notably by the Presbyterian Church, the Methodist Episcopal Church and the Methodist Episcopal Church, South. The proceedings of most of these conventions have been published in full. These conventions have discussed more than the missionary movement. They have included in their programs many things pertaining to a general forward movement of the Church. The movement spread to England and Scotland in 1907. By invitation six American laymen represented the movement to the people of Great Britain. Within 30 days England and Scotland each had an organization at work. The movement employs a general secretary with headquarters at 1 Madison Square, New York. There is no membership and no organization apart from a series of committees. There is a general committee of approximately 100 laymen, which meets annually, giving general direction to the movement. An executive committee of 25 members meets each month in New York city, giving closer supervision to the work. Division committees are developed in different sections of the United States to give immediate direction to the work in their own territory. In each separate city, community or county where work is undertaken a co-operating committee of the movement is organized to give it direction and assistance. Detailed suggestions are printed for the guidance and help of such committees.

The chief features of a standard missionary church, as emphasized by the Laymen's Missionary Movement, are the following: 1. A missionary pastor. 2. A missionary committee. 3. A missionary Sunday school. 4. Systematic missionary education, including: *a.* Regular missionary meetings. *b.* The use of missionary literature. *c.* Organized mission study classes. 5. A program of prayer for missions. 6. An annual every-member canvass for missions. 7. The weekly offering for missions.

By the use of these methods whole cities have already more than doubled their entire previous missionary offerings. It is the purpose and hope of the movement to assist in enlisting the men of all churches in the steady support of a missionary policy adequate to the presentation of the gospel of Christ to every creature.

When the Laymen's Movement began its work very few churches had discovered the value of the missionary committee. The reasons for having such a committee in every congregation may be summarized as follows:

The missionary committee 1. Divides and locates responsibility. 2. Enlists lay activity. 3. Reinforces the pastor's efforts. 4. Challenges to the study of missions. 5. Provides a great opportunity for Christian service. 6. Reaches the membership individually. 7. Stimulates the spiritual life of its members. 8. Greatly increases intelligence, intercession and offerings.

Many thousands of these committees have been appointed as the result of the agitation conducted by the Laymen's Movement. It is estimated that some hundreds of thousands of laymen are now serving as members of such committees.

Missionary offerings have increased largely as a result of the movement. In 1905, the year before the movement was organized, the churches of the United States and Canada were giving $8,120,725 for foreign missions. In 1915 they gave $18,793,000, a cumulative gain of a million dollars a year. In other words, the churches were now giving $10,000,000 a year more than they gave in 1906.

From its inception in 1906 to 1916 the Movement organized fully 3,000 conferences and conventions, attended by at least a million men. Two national campaigns have been conducted in which there was a paid registration of 175,000 delegates. The first national campaign, in 1909–10, closed with a congress in Chicago, the second, in 1915–16, culminated in a similar national congress in Washington, D. C.

The periodical of the movement, *Men and Missions*, has been published regularly since 1909, millions of pieces of printed matter have been distributed and a vast amount of publicity has been given the missionary enterprise in the press and in connection with the conventions of the Movement.

LAYNEZ, lī'nāth, or **LAINEZ, Diego,** dē-ā'gō, second general of the Jesuits: b. Almancario, near Siguenza, Castile, 1512; d. Rome, 19 Jan. 1565. He studied in Alcala and Paris, in which latter town he joined with Ignatius Loyola in founding the order of Jesuits. His especial work was to travel over Europe to gather new members and spread the influence of the order, when its constitution had been confirmed and approved by Pope Paul III (1540). He was very successful in extending the Society of Jesus. He was a man of marked ability and as a consulting theologian took a conspicuous part in the Council of Trent. He had succeeded Loyola as general of the Jesuits in 1556. On the death of Paul IV he avoided the chance of election to the tiara, and refused a cardinal's hat. Consult Boero, ‹Vie du P. Jacques Lainez› (1894).

LAYS OF ANCIENT ROME. Macaulay's purpose in the ‹Lays of Ancient Rome› (published 1817) was to recreate some of the old folk poems which he suspected to have been the sources of some of the most striking incidents recorded by the historians of early Rome. For models he took Homer and the English popular ballads. The Lays sound neither like Homer nor any ballad, but like Macaulay. He adapted the ballad stanza almost out of all recognition to fit his own ringing rhetorical style, and he used his classical learning to supply abundant concrete details for that vivid description of men and places and for that vigorous narrative for which he was famous. This is particularly true of ‹Horatius,› where the subject, with its contrasted personalities and stirring action, was especially congenial. It is almost as true of ‹The Battle of Lake Regillus,› though the incident there is neither so striking nor coherent. It is not so true of ‹Virginia› which demanded more restraint and more subtle feeling than Macaulay could bestow, nor ‹The Prophecy of Capys,› which demanded more epic splendor. The popularity of the ‹Lays› has been great and well-deserved.

Up to 1875 a hundred thousand copies had been sold. They are not great poetry, but Macaulay himself, who used to recite 'Horatius' to a boy, would have been satisfied to know that that poem at least would continue to be enjoyed by all boys who love to declaim stirring rhetoric and swinging verse.

WILLIAM HALLER.

LAZARETTO, a name given in Italy and other parts of southern Europe and also in Hawaii and in California to isolated hospitals for such as are afflicted with contagious disorders. The name is derived from Saint Lazarus, who (from the unauthorized idea that he was a leper) is the patron saint of lepers; and during the Middle Ages, when leprosy was common in Italy and other parts, the hospitals in which the lepers were confined received that name, and the lepers themselves were called lazzari. Howard wrote 'An Account of the Principal Lazarettos in Europe' (1789). Those buildings and enclosures attaching to seaport towns chiefly on the Mediterranean, where the crews and passengers of ships from places where contagious disease is known to prevail, are also called lazarettos. These lazarettos consist generally of various detached buildings, with courts between, the whole being surrounded by a wall and placed in an airy situation outside the town or sometimes on a small island near the coast. See also QUARANTINE.

LAZARILLO DE TÓRMES, lä'thạ-rē'lyō dā tọ́r'mās, the first of the picaresque or rogue novels and the most complete early example of modern realistic fiction, takes important rank in the history of literature as a satiric picture of Spanish life during the Renaissance, of vividness, directness and power. The story, although a sequence of episodes or adventures presented from the point of view of below stairs, possesses exceptional unity of characterization in which the satire is wholly fused, the progress of the action developing through the pursuit of various forms of false pretense as the anti-hero, or *pícaro*, passes through the service of masters unprincipled as himself, who are differentiated from him by superior experience and social position, and by the hypocrisy which the support of their position entails. In style the book is simple and vigorous, with the bluntness of common speech, antedating the affectations of the Golden Age, surpassing in force and restraint the later productions of the picaresque school, all of the characteristics of which are to be found clearly marked in its pages. The prototypes of Lazarillo must be sought among the *fabliaux* and later kindred Spanish developments at the hands of the archpriest of Hita and others; to these the 'Celestina' and the precept of classical writers, Apuleius and Petronius, may be added. A number of traditional mediæval tales are also incorporated. The influence of the story was continuously active during the 17th and 18th centuries, especially in the novel of Fielding and Smollett, while the 'Gil Blas' of Le Sage is a direct descendant. Of the seven episodes, or treatises, of the original work, the first, in which the boy Lazarillo enters the service of the blind beggar, is the most mordant and real, the apparent fruit of direct observation.

The earliest known editions are those of Alcalá and Burgos, 1554, based probably upon an original issued during the preceding year. Both were published anonymously, but in 1607 the authorship was attributed to the poet diplomatist, Diego Hurtado de Mendoza, whose claim has since been rejected by competent scholars. Previous to publication, 'Lazarillo' circulated in manuscript, to which fact variants in the versions current may be ascribed. An anonymous continuation appeared at Antwerp in 1555, but the most familiar of the second parts is that by Juan de Luna, a Spaniard resident at Paris (1620). All these second parts are fantastic and in large measure allegorical, missing both the spirit and force of the original. 'Lazarillo' was prohibited in the Index Expurgatorius of 1559, since which date it has circulated in Spain chiefly in modified form as the 'Lazarillo Castigado.' David Rowland completed an English translation (London 1576), probably through the French. Subsequent renderings are by Thomas Roscoe, (1832), and Louis How (New York 1917); upon scholarly and literary grounds, How's version is the most satisfactory. For history and bibliography of 'Lazarillo,' consult Chandler, F. W., 'Romances of Roguery' (New York 1899); Fonger de Haan, 'An Outline of the History of the Novela Picaresca in Spain' (The Hague and New York 1903); Menéndez y Pelayo, M., 'Orígenes de la Novela Española' (Madrid, in the 'Nueva Biblioteca de Autores Españoles').; also C. P. Wagner's introduction to How's translation.

JOHN GARRETT UNDERHILL.

LAZARISTS, or FATHERS OF SAINT LAZARUS, a congregation of the Roman Catholic Church, originally known as "Priests of the Mission," founded at Paris by Saint Vincent de Paul in 1625 for the purpose of supporting missions and ministering to the spiritual wants of the poor at home, and in foreign parts, especially Barbary. The foundation was confirmed by letters patent of Louis XIII, May 1627, and the missionaries were erected into a congregation by Pope Urban VIII in 1631. At the time of the Revolution they included 1,195 members and 63 houses. In 1817 they established themselves in the United States. See ORDERS, RELIGIOUS.

LAZARUS (abridged form of the Hebrew name Eleazar, "God has helped"), name of two persons in the New Testament. 1. Lazarus of Bethany, brother of Martha and Mary, and a friend of Jesus. John xi, xii, narrates the miracle of Jesus raising Lazarus from the dead after he had lain four days in the tomb. Beyond the mention of Lazarus' presence at the banquet which Simon the Leper gave Jesus (Matthew xxvi, 6–16; Mark xiv, 3–11; Luke x, 40; John xii, 1–11) there is no further reference to him or the miracle of his raising from the dead. The miracle is stated in John xii, 1–11, to have produced a great effect upon the Jews, converting many to a belief in Jesus and thereby caused the high priests to seek the death of Lazarus as well as of Jesus. There has been a wide controversy concerning the authenticity of the miracle, grounded in part upon the failure of the other Synoptists to mention it despite its significance. Supporters of the actuality of the miracle are inclined to consider doubts cast upon it as evidences of enmity to Christianity. (2) The beggar in the parable «Lazarus and Dives» (Luke vi, 20), this constituting the only occurrence of a proper name in a parable, and used probably merely as characterization, and not with any thought of connecting the beggar with Lazarus of Bethany. The description of the beggar at the gate of the wealthy Dives, covered with sores and longing vainly for the crumbs from the table, doubtless gave rise to the assumption that he was a leper, an unfounded belief which nevertheless became widespread and the name passed into many languages as identified with leprosy. The story appears only in the gospel of Luke.

LAZARUS, Emma, American poet; b. New York, 22 July 1849; d. there, 19 Nov. 1887. Trained at home under the personal direction of her father, Moses Lazarus, a New York merchant of prominence in the social and business world, she early displayed intellectual promise. From her childhood books were her most precious possession and her mind was turned to poetry for its utterance — the Civil War inspiring her first lyric outbursts. Her earliest productions, ‘Poems and Translations’ (1867), were marked by a seriousness if not sombreness, incomprehensible in one so young, whose life, too, was full of happy anticipations. In her second volume, four years later, there was more artistic completeness, and a certain consciousness of power gave more strength to her verse. Her ‘Admetus and Other Poems’ (1871) was favorably received, and its classic atmosphere showed distinct talent, while, side by side with its imaginings in ‘Admetus’ and ‘Tannhäuser’ were its flashes of personal experience in ‘Epochs’ and the musical rhapsodies in ‘Phantasies.’ In 1874 her love for German literature was evidenced in her ‘Alide,’ a story of Goethe's Sesenheim period, so far as its background is concerned, wherein she has admirably incorporated whole passages from the ‘Autobiography’ to give naturalness to the episode. It is a charming romance, which won high praise from Tourgeneffs as the work of one who «is not a pupil in art any more» and «is not far from being a master.» Her next book printed for private circulation, ‘The Spagnoletto’ (1876), a five-act tragedy of the 17th century, was remarkable at least for the new note in treatment, its stormy sweep of passion, so unlike the calm, reflective emotion of her poems. It was in 1878, when she was giving the finishing touches to translations from Heine, that a new theme was suggested to her — the translation into English of representative Jewish poets of the Spanish school. With enthusiasm she responded to the appeal, and, desiring to reproduce the spirit of the original, studied Hebrew with rare diligence and soon grew independent of German paraphrase. The ease with which she mastered the mediæval Jewish poets and the interest she displayed in Jewish history were preparations for a more important work. A little volume was shown her — ‘Der Tanz zum Tode’ by Reinhard, based on historical data furnished by Franz Delitzsch, as a more elaborate treatment. Her ‘The Dance to Death’ was the result, for which she was unable to find a publisher until it was issued as a serial in a Jewish weekly, and appeared about the time of the Russian Jewish persecution of 1882, although it was written without any reference to those outbreaks. In the American movement to aid the refugees, she took a helpful part. She wrote for *The Century* (May 1882) an impassioned article, ‘Russian Christianity *versus* Modern Judaism,’ wherein she championed her brethren and refuted their critics and assailants. In prose and verse she further strove to vindicate her ancestral creed and inspire its followers to brotherhood and useful activity. In *The Century* for February 1883 she pleaded for «a restored and independent nationality and repatriation in Palestine.» After her father's death in March 1885 her own health failed slowly and the end came in November 1887, just at the time when her powers were ripest and her opportunities seemed at their greatest. In addition to the volumes already named she published ‘Poems of Heinrich Heine’ (1881); ‘Songs of a Semite’; ‘The Dance to Death, and Other Poems’ (1882). Her collected poems were issued in two volumes in 1889.

ABRAM S. ISAACS,
Professor of Semitic Language, New York University.

LAZARUS, lä'tsą-rūs, **Moritz,** German philosopher: b. Filehne, Posen, 15 Sept. 1824; d. Meran, Tyrol, 13 April 1903. He was the son of a Jewish scholar, was educated in Hebrew literature and history, and studied law and philosophy at the University of Berlin. He was professor in the University of Berne in 1860–66, professor of philosophy at the Military Academy at Berlin in 1868–73, and in 1873 was appointed professor at the University of Berlin. His philosophy was a development of the Herbartian theory and he became a leader in that school. With H. Steinthal he founded the *Zeitschrift für Volkerpsychologie und Sprachwissenschaft* in 1859, and made numerous contributions to it. He was president of the first and second Jewish Synods at Leipzig, 1869, and Augsburg, 1871. He received the title Geheimrath on his 70th birthday. Author of ‘Das Leben der seele’ (1855–57; 3d ed., 1883); ‘Ueber den Ersprung der Sitten’ (1860; 2d ed., 1867); ‘Ueber die Ideen in der Geschichte’ (1865; 2d ed., 1872); ‘Zur Lehre von den Sinnetäuschungen’ (1867); ‘Ideale Fragen’ (1875; 2d ed., 1885); ‘Erziehung und Geschichte’ (1881); ‘Unser Standpunkt’ (1881); ‘Ueber die Reize des Spiels’ (1883); ‘Der Prophet Jeremias’ (1894); ‘Die Ethik des Judentums’ (1898; new ed., 1911); ‘Die Erneuerung des Judentums’ (1909).

LAZETCHNIKOV, lą-zĕch'nyē-kōf, or **LAZHECHNIKOV,** or **LAZJETJNIKOV, Ivan Ivanovitch,** Russian novelist and dramatist: b. 1794; d. 1869. He was engaged in teaching after his retirement from the army in 1819 and gained considerable success as a writer of historical romances and of dramas. Author of ‘Poslednii Novik’ (1833); ‘Ledianyi Dom’ (1835); ‘Basurman’ (1838). His collected works were published at Petrograd (1858; new ed., 1884).

LAZULI FINCH, a small brilliantly blue finch (*Cyanospiza amœna*) of the Western States. frequently kept as a cage-bird. It is much like its relative, the eastern indigo-bird (q.v.).

LAZULITE, a mineral, which is not to be confused with lapis lazuli (q.v.), is found in Austria, Switzerland, Sweden, Brazil and in North Carolina and Georgia. It occurs massive and also well crystallized in monoclinic crystals of steep-pyramidal habit. It has a fine blue color and vitreous lustre and is semi-translucent. It is moderately hard, but brittle; specific gravity, 3.1. It is a hydrated phosphate of aluminum, iron and magnesium, but it also contains lime, and sometimes silica.

LAZZARONI, lăd'zą-rō'nē, Italian name for the poorest class in Naples, people who are homeless and live chiefly by begging, although intermittently they may fish and perform odd jobs. There was a rising among them in French Revolutionary times and during the Napoleonic era, their sympathies being with the Bourbons. At that time they attacked and pillaged people of wealth and of the nobility whom they suspected of sympathy with the new era.

LE BAS, Philippe, fē-lēp lė-bă, French historian and archæologist: b. Paris, 17 June 1794; d. there, 1861. At 16 he entered the navy, which he left three years later for the army and he shared in the campaigns of 1813–14. In 1820 he was chosen by Queen Hortense to act as tutor to Prince Louis Napoleon, later Napoleon III, with whom he remained until October 1827. After holding professorships at Paris successively of history and of the Greek language and literature, he was commissioned in 1842 by the French government to undertake a tour of archæological investigation in Greece and Asia Minor, during which he made many valuable discoveries. He published books on very varied subjects, embracing essays on classical inscriptions, editions of ancient authors, travels, ancient and mediæval history, politics, instruction in German and translations from German and English. His best-known works are his ‘Explication des inscriptions grecques et latines recueillées en Grèce’ (1835–37) and ‘Voyage archéologique en Grèce et en Asie Mineure’ (1847 et seq.).

LE BLANT, lĕ blăṅ', **Edmond Frédéric**, French archæologist: b. Paris, 12 Aug. 1818; d. there, 3 July 1897. He began his archæological investigations while on a journey to Rome in 1847 and thereafter made the study his lifework, specializing in Christian epigraphy and the history of early Christian institutions in France. His investigations in these fields are of acknowledged importance. He was elected to the Academy of Inscriptions in 1867, and in 1883–89 he was director of the École Français at Rome. Besides numerous scientific papers he was author of ‘Inscriptions chrétiennes de la Gaule antérieures au Viii ème siècle’ (1856–65); ‘Manuel d'épigraphie chrétienne’ (1869); ‘Les sarcophages chrétiens de la Gaule’ (1886); ‘L'Épigraphie chrétienne en Gaule et dans l'Afrique romaine’ (1888); ‘Les persécuteurs et les martyrs aux premiers siècles de notre ère’ (1893), etc. He collaborated with Jacquemart in the preparation of ‘Histoire artistique de la Porcelain’ (1861–62).

LE BLOND, le'blŏnd', **Elizabeth Alice Frances** (MRS. AUBREY), British author and Alpinist: b. Wicklow County, Ireland, about 1860. She was the only child of Sir St. Vincent Bentinck Hawkins-Whitshed, Bart., and succeeded to the title of a Hanover baroness. She was married to Col. Frederick Burnaby in 1879, widowed in 1885; married to John Frederick Main in 1886 and widowed in 1892; and in 1900 she was married to Aubrey Le Blond. She is famous as a mountain climber making the most difficult ascents in the Swiss and Dauphiné Alps and in Arctic Norway. She was elected first president of the Ladies' Alpine Club in 1907. She has been an extensive contributor to periodicals, makes the photographs used to illustrate her travel books and has lectured on mountain climbing, using her own slides as illustrations. Author of ‘The High Alps in Winter’ (1883); ‘High Life and Towers of Silence’ (1886); ‘Adventures on the Roof of the World’ (1904); ‘Mountaineering in the Land of the Midnight Sun’ (1908); ‘A Guide to Old Gardens in Italy’ (1912); ‘The Life and Times (1715–1800) of Charlotte Sophie, Countess Bentinck’ (2 vols., 1912), etc.

LE BOEUF, lĕ'bēf', **Randall James**, American lawyer: b. Cohoes, N. Y., 10 March 1870. He received his education at Cornell University and was admitted to the bar in 1893. After practising in New York city he returned to Albany and became a member of the firm of Burlingame and Le Boeuf. Since 1898 he has practised alone. From 1897–1901 Le Boeuf was corporation counsel of the city of Rensselaer, and in 1909 was appointed justice of the Supreme Court of New York, retiring in 1911. He was a member of the New York State Banking Commission which revised the banking laws in 1913. Judge Le Boeuf has traveled extensively in Alaska, West Indies and on the Continent.

LE BON, lĕ bôṅ', **Gustave**, French physician, ethnologist and psychologist: b. Nogent-le-rotrou, 1841. He received his M.D. in 1876 but abandoned the practice of medicine for ethnological and psychological research. He was appointed chief of the government expedition to India for the study of the architecture of the Buddhist monuments in 1884. Author of ‘L'Homme et les sociétés’ (2 vols., 1877); ‘Les monuments de L'Inde’ (1894); ‘Lois pyschologiques de l'évolution des peuples’ (1895; English translation, ‘The Psychologies of the Peoples,’ 1898; 2d ed., 1912); ‘L'Evolution des forces’ (1899; English translation, 1908); ‘Psychologie de l'education’ (1904; 13th ed., 1909); ‘L'Evolution de la matière’ (1905; English translation, 1907); ‘La révolution francaise et la psychologie des révolutions’ (1912; English translation, ‘The Psychology of Revolution,’ 1913), etc.

LE BON, Joseph, French politician: b. Arras, 29 Sept. 1765; d. Amiens, 10 Oct. 1795. He entered the priesthood, was professor of rhetoric at Beaune and later joined the revolutionists. He served as mayor of Arras and administrator of Pas-de-Calais, and in 1793 took his seat in the Convention. Under a commission by the Convention he succeeded in preventing Cambrai from being taken by the

Austrians, displaying marked courage and ability. Later, however, the severity of his dealings with the opponents of the Revolution in the departments of the Somme and Pas-de-Calais, coupled with the enmity of his political adversary, Armand Cuffroy, caused his trial before the tribunal of the Somme and his subsequent condemnation and execution. Consult Emile le Bon, 'Histoire de Joseph le Bon et des tribunaux révolutionnaires d'Arras et de Cambrai' (2d ed., 2 vols., 1864).

LE BOULENGE, lĕ boo'län'zhä, or **LE-BOULANGE, Paul Emil,** Belgian soldier: b. Mesnil-Eglise, 11 March 1832; d. Ostend, 30 May 1901. He early entered the artillery service and reached the rank of lieutenant-general upon his retirement in 1897. He was an expert in ballistics and invented the Le Boulenge chromograph. Author of 'Etudes de balistique expérimentale' (1868); 'Description et emploi du chronographe Le Boulenge' (1869; 2d ed., 1877); 'Télémètre de fusil' (1875); 'Détermination des vitesses velocipediques, Volographes' (1894), etc.

LE BRAZ, lĕ bräs', **Anatole,** French novelist: b. Duault, 2 April 1859. He was educated in Paris and engaged in teaching, becoming professor of French literature at the University of Rennes in 1905. In his literary work he has specialized in the legends and customs of old Brittany and he has lectured extensively on the subject. He made several lecture tours of the United States under the auspices of the French Alliance. Besides numerous contributions to magazines he is author of 'Tryphina Keranglas' (1892); 'La chauson de Bretagne' (1892); 'Au pays des Pardons' (1895; English translation, 1906); 'Paques d'Islande' and 'Vieilles histoires du pays breton' (1897); 'La terre du passé' (1902); 'Les coutes du soleil et de la brume' (1905); 'Au pays d'exit de Chateaubriand' (1909); 'Ames d'occident' (1912), etc.

LE BRUN, lĕ brün', **Napoleon Eugene Charles Henry,** American architect: b. of French parents, Philadelphia, 2 Jan. 1821; d. New York, 9 July 1901. He was a pupil of Thomas U. Walter, the architect, and from 1842 to 1861 practised his profession in Philadelphia where his most notable work is the Roman Catholic cathedral in Logan Square. He removed to New York in 1861 and among structures there which were designed by him with his son are the Foundling Asylum and the Metropolitan Life Insurance building in Madison Square.

LE CARON, lĕ kä'rôn', **Henri** (real name THOMAS MILLER BEACH), British secret service agent: b. Colchester, 26 Sept. 1841; d. London, 1 April 1894. He assumed the name Le Caron when he came to America in 1861 to join the Union forces in the Civil War. He served through the war, rising to the rank of major. In 1865 he learned of the Fenian plot against Canada and communicated with the authorities in England. He was thereupon engaged by the British government as a military spy and until 1889 was in closest communication with the Fenian organization. His reports enabled the British government to defeat the Canadian invasion of 1870 and led to the surrender of Riel in 1871. He lived for 25 years in America, chiefly in Detroit, gathering information for his government and making occasional trips to Europe. In 1889 he was summoned by the London *Times* to give his testimony before the Parnell Commission, a proceeding which automatically ended his career as a secret service agent. Author of 'Twenty-five Years in the Secret Service' (6th ed., 1892).

LE CARON, Joseph, French missionary: d. 1632. He was a Franciscan, belonging to the congregation of Récollets. His work in Canada (he landed at Tadoussac, 25 May 1615) was chiefly among the Huron tribe, and he was the first European to explore the lake of that name. His indefatigable labors among the Indians met with scant success, though he left some valuable information concerning their language, which was of great value to his successors. The name of Le Caron is of special interest in connection with the origin of the Christian religion in Canada: the first mass in what is now the province of Quebec was celebrated by him (and Father Jamay) on the Rivière des Prairies, near the western extremity of the island of Montreal, 24 June 1615; on 12 August of the same year the first mass in Ontario was sung by him near Thunder Bay; and in 1617 at Quebec he officiated at the first marriage in Canada. After Kirke's capture of Quebec (1629) he was deported to England with others of the French population and never returned to the monastery which he had built in that city.

LE CHAPELIER, lĕ shä'p'lyā', **Isaac René Guy,** French revolutionist: b. Rennes, 12 June 1754; d. Paris, 22 April 1794. He was a lawyer by profession and in 1789 he was elected to the States-General. He was one of the founders of the Breton Club and on 3 Aug. 1789 he was chosen president of the Constituent Assembly. He was one of the principals on the committee which drafted the new constitution and he opposed Robespierre's proposal that members of the Constituent Assembly should be barred from election to the new assembly. The extreme measures adopted by the revolutionists gradually moderated Le Chapelier's opinions and on 29 Sept. 1792 he introduced a measure for the restriction of the clubs. A visit to England on professional business made a pretext for the extremists to charge him with conspiring with foreign nations and he was brought before the Revolutionary Tribunal, condemned and executed.

LE CHÂTELIER, lĕ shä'tĕ'lyā', **Henri Louis,** French chemist: b. Paris, 8 Oct. 1850. He studied at the Collège Rollin, the École Polytechnique and the École des Mines. He was appointed professor of chemistry at the École des Mines in 1877, and in 1882 became professor of mineralogical chemistry there. He was called to the chair of mineralogical chemistry at the Collège de France in 1898. He has made extensive researches, and is the inventor of appliances for use in experiments in chemistry and physics. He is a chevalier in the Legion of Honor, was president of the Société Minéralogie in 1898 and of the Société de Physique in 1907. He is an extensive contributor to scientific journals and is author of 'Cours de chimie industrielle' (1896; 2d ed., 1902); 'High Temperature Measurements' translated by G. K. Burgess (1901); 'Recherches expérimentals sur la constitution des mortiers hydrauliques' (1904; English translation 1905); 'Introduction à l'étude de la metallurgie' (1912); 'La silice et les silicates' (1914); 'Les explosifs' (1915), etc.

LE CLEAR, le klēr, **Thomas,** American painter: b. Owego, N. Y., 1818; d. New York, 1882. He painted portraits in London, Canada, before he had received any instruction in art, and left that place about 1832 for New York, where he made his principal residence. He was elected a National Academician in 1863. Besides his portraits, which are clever in characterization and full of life and expression, he has painted many genres, such as 'Marble Players'; 'The Itinerant' (1862) and 'Young America.' Among his portraits are those of 'William Page' in the Corcoran Gallery at Washington; and 'George Bancroft' in the Century Club, New York.

LE CLERC, lė-klär, **John,** or **Johannes Cler'icus,** Swiss theologian: b. Geneva, Switzerland, 19 March 1657; d. Amsterdam, Netherlands, 8 Jan. 1736. He began to study theology and philosophy in his native town, and continued his studies at Grenoble, Saumur, Paris and London. He gradually adopted the views of the Remonstrants, as the adherents of Arminius (q.v.) were then called. In 1684 he was appointed to the faculty of the Remonstrant College at Amsterdam. In 1728 a stroke of apoplexy deprived him of his power of speech, which he never recovered. His influence has been most widely felt through his writings, which are voluminous. He edited the 'Apostolic Fathers of Cotelerius' (1698), and the views he held about Mosaic authorship, inspiration and kindred topics seemed to anticipate some recent deductions from the Higher Criticism. Besides a Bible commentary he published 'Bibliothèque universelle et historique' (25 vols., 1686–93); 'Bibliothèque choisie' (28 vols., 1703–13); and 'Bibliothèque ancienne et moderne' (29 vols., 1714–26).

LE CLERC, Sébastien, French designer and engraver: b. Metz, Lorraine, 26 Sept. 1637; d. Paris, 25 Oct. 1714. He acquired the elements of design from his father, a goldsmith, and by the advice of Le Brun devoted himself to engraving, in which he became so distinguished that at the suggestion of Colbert he was appointed engraver in ordinary to Louis XIV. Pope Clement XI also conferred upon him the honor of knighthood. He formed his style on that of Le Brun, improving it, however, by a careful study of Raphael; and in his published works, which number between 3,000 and 4,000, and embrace every variety of subject he has exhibited a singularly correct and elegant execution. He also published treatises on geometry, architecture and perspective. Consult De Vallemont, 'Elogue historique de Sebastien Le Clerc' (Paris 1715); Jombert, 'Catalogue de l'œuvre de S. Le Clerc' (Paris 1774).

LE CLERQ, Chrétien, krā-tē-ŏṅ lė klär, French missionary: b. Artois, France, about 1630; d. Lens, France, about 1695. He labored as a Récollet missionary in the peninsula of Gaspe, Canada, with intervals, from 1675–87, and invented a system of hieroglyphics which he taught the Micmacs. His works are interesting as throwing a side light upon early Canadian history, but are tinged with ecclesiastical partiality for Frontenac, who favored the Récollets at the expense of the Jesuits. These works are 'Nouvelle relation de la Gaspésie' (1691), and 'Establishment of the Faith in New France' (English translation by John G. Shea 1881).

LE CONTE, le kŏnt, **John,** American physicist: b. Liberty County, Ga., 4 Dec. 1818; d. Berkeley, Cal., 29 April 1891. He was a son of Lewis Le Conte. He was graduated from Franklin College in 1838, from the College of Physicians and Surgeons, New York, in 1841; in 1846–55 was professor of natural philosophy and chemistry in Franklin College; in 1856–69 was protessor of natural and mechanical philosophy in South Carolina College; in 1869 became professor of physics and industrial mechanics in the University of California; was president of the university in 1876–81; and in 1881 again assumed his professional duties. Among his publications were 'The Philosophy of Medicine' (1849), and 'The Study of the Physical Sciences' (1858).

LE CONTE, John Eaton, American naturalist: b. near Shrewsbury, N. Y., 22 Feb. 1784; d. Philadelphia, 21 Nov. 1860. He was a brother of Lewis Le Conte. In 1813 he entered the army as a topographical engineer, and in 1831 was retired with the grade of major. He published 'Monographs of North American Species of Utricularia, Gratiola and Ruellia,' and other studies in natural history.

LE CONTE, John Lawrence, American entomologist: b. New York, 13 May 1825; d. Philadelphia, 15 Nov. 1883. He was a nephew of Lewis Le Conte. He was graduated from Mount Saint Mary's College (Emmitsburg, Md.) in 1842, from the College of Physicians and Surgeons in 1846, became a surgeon of volunteers in the Federal army in 1862 and was later made medical inspector United States army, with rank of lieutenant-colonel. In 1873 he was chosen to the presidency of the American Association for the Advancement of Science. He was generally recognized as an important authority on entomology; and published on that subject 'Classification of the Coleoptera of North America' (1862–73); 'List of the Coleoptera of North America' (1866); and 'New Species of North American Coleoptera' (1866–73).

LE CONTE, Joseph, American geologist: b. Liberty County, Ga., 26 Feb. 1823; d. Yosemite Valley, Cal., 6 July 1901. He was a son of Lewis Le Conte. He was graduated from Franklin College, Georgia, in 1841, from the College of Physicians and Surgeons, New York, in 1845; practised medicine at Macon, Ga.; in 1850 became a pupil of Louis Agassiz, whom he accompanied on an expedition to Florida; and later was professor of natural science in Oglethorpe University, Georgia, and of natural history in Franklin College. In 1856–69 he was professor of chemistry and geology in the University of South Carolina, and from 1869 until his death held the chair of geology in the University of California. During the Civil War he was chemist in the Confederate medicine laboratory and later in the nitre and mining bureau at Columbia, S. C. He was president of the American Association for the Advancement of Science in 1892. His contributions to geology include the determination of the character and age of the Cascade Range; the description of the ancient glaciers of the Sierra Nevada; the development of what is called the «contractional theory» in mountain building; and researches in vein formation. He wrote also on optics, philosophy, biology and other subjects. He was an editor of the *Journal of Geology and of Science*, and published ‘Religion and Science’ (1873), a collection of lectures; ‘Elements of Geology’ (1878), his best-known book; a ‘Compend of Geology’ (1884); ‘Evolution: Its Nature, its Evidences, and its Relation to Religious Thought’ (1887); and other writings. Consult his ‘Autobiography,’ edited by Armes (1903).

LE CREUSOT, France. See CREUSOT, LE.

LE CRIME DE SYLVESTRE BONNARD. In general, modern French writers of fiction are models of conciseness and directness: they follow the tale to its conclusion without turning from the road to wander in meadows, however tempting. The ability to say «No» to their fancy is not the least of their merits. It was inevitable that there should be writers who attained their purpose by the opposite method — that of digressions and detours, of an apparent neglect of continuity and sequence. These authors rely on the effects of surprise of whimsical fancy. Among them is Anatole France. Thousands of readers, who had grown tired of the logical severity and directness of the ordinary French novel, found themselves under the spell of his wandering fancy.

None of France's stories is more delightful in this regard than ‘The Crime of Sylvestre Bonnard.’ Here is a book to charm sensitive and generous souls who are weary of the more sordid and vulgar aspects of life. It is the love story of an aged academician and bibliophile — but without a dull page. It mentions, to be sure, books, tomes and parchment, but it also mentions cats, a tyrannical and devoted old family maid, an extravagant voyage to Sicily, an irresistible Russian princess, children, youth, bonbons and violets. The portraits of Sylvestre Bonnard, Mme. De Gabry, Jeanne are thoroughly and exquisitely French. The style is that for which the author is celebrated — subtle, suggestive, polished to the last degree of delicacy and grace.

RAYMOND WEEKS.

LE DENTU, lĕ dän'tü, **Jean François Auguste**, French surgeon and writer: b. Basse-Terre, Guadeloupe, 21 June 1841. He took his M.D. at Paris in 1867, became a member of the faculty in 1869, professor of pathological surgery there in 1888, and of clinical surgery in 1891. He acted as surgeon at the Hôtel Dieu from 1872, and in 1889 he was elected to the Academy of Medicine. He collaborated with Pierre Delbet in the preparation of ‘Traité de chirurgie clinique et opératoire’ (1895–1901), and ‘Nouveau traité de chirurgie’ (1908–09). Author of ‘Maladies de la prostrate et de la vessie’ (1881); ‘Traité des affections chirurgicales des reins, des uretères et des capsules surrénales’ (1889); ‘Le cancer du sein’ (1902); ‘Visions d'Egypte’ (1911), etc.

LE DIABLE BOITEUX, lĕ d'yäbl' bwä'tė, «The Limping Devil» (1707), by Le Sage, seems from its title a translation or adaptation of ‘El diablo cojuelo’ of the Spaniard Quevara, from which, however, it took only the general idea and some two and a half chapters out of 21. This idea was that Asmodeus, a devil, removing the roofs from the houses of Madrid, «as one takes the top-crust from a pasty,» should reveal to his companion the intimate life of typical personages when removed from the restraints of publicity. Lesage adapted this scheme to a satire on the social life of contemporary Paris. His book is thus, if we look beneath the surface, more akin to the ‘Characters’ of La Bruyère than to Quevara's tale, which merely supplied Lesage with the connecting links that were lacking in La Bruyère's studies. Much in the work is necessarily local and transitory. Many of the witty sketches had lost their point even in Lesage's own time, with the disappearance of the personages they satirized. These were omitted in a second edition. The author's declaration in the preface that he meant no one in particular could put off the track only the very innocent, and aroused the others to elaborate «keys» which added much to the great vogue of the book. There are hits at Fontanelle and La Motte, at Ninon de l'Enclos and the noted actor Baron. In a later edition Voltaire is quipped in terms which the author of the ‘Henriade’ never forgot nor forgave. But in spite of the ingenuity with which the shifting scenes are connected and the wit with which human foibles are portrayed, ‘The Limping Devil’ inevitably lacks the unity of structure that alone can produce great artistic effect in a work of fiction. It has been translated under the title ‘Asmodeus.’

BENJAMIN W. WELLS.

LE FANU, lĕ-fä'nü or lĕf'ą-nü, **Joseph Sheridan**, Irish journalist and novelist: b. Dublin, 28 Aug. 1814; d. there, 7 Feb. 1873. Having graduated from Trinity College, Dublin, he joined (1837) the staff of the *Dublin University Magazine*, at first as contributor, and afterward as editor and proprietor. Among modern Irish novelists he stands next in popularity to Charles Lever. ‘The House by the Churchyard’ appeared in 1863, and was succeeded by ‘Uncle Silas’ (1864), his most powerful work; ‘Guy Deverell’ (1865); ‘The Tenants of Malory’ (1867); ‘The Wyvern Mystery’ (1869); In a Glass Darkly’ (1872), etc.

LE FLO, lĕ flō, **Adolphe Charles Emmanuel**, French general and diplomatist: b. Lesnevin, 2 Nov. 1804; d. Néchoat, 16 Nov. 1887. He studied at the École Militaire de Saint Cyr in 1823–25, entered the army and served in the African campaigns of 1831 and 1848, rising to the rank of brigadier-general. He was appointed Ambassador to Russia, 23 Aug. 1848, but in the following year he returned to take his seat in the National Assembly. His opposition to the plans of Louis Napoleon caused his exile from France, 9 Jan. 1852, and it was not until 1857 that he was permitted to return. He took no further part in politics during the reign of Napoleon III, but served as Minister of War for a time during the Franco-Prussian War and at the end of the war was reappointed to that office. He was again Ambassador to Russia in 1871–79. He published (1887) the documents relative to the Franco-German crisis of 1875, which, with the aid of Alexander II, he guided to a peaceful termination.

LE GALLIENNE, lĕ găl'lĭ-ĕn, **Richard**, English author: b. Liverpool, England, 20 Jan. 1866. He was educated at Liverpool College and after several years spent in business served as literary critic for the *Star* and settled in London. Since 1902 he has lived in New York. Among his numerous published works are 'My Ladies' Sonnets' (1887); 'Volumes in Folio' (1888); 'George Meredith' (1890); 'The Book-Bills of Narcissus' (1891); 'English Poems' (1892); 'The Religion of a Literary Man' (1893); 'Prose Fancies' (1894–96); 'Robert Louis Stevenson and Other Poems' (1895); 'Retrospective Reviews' (1896); 'The Quest of the Golden Girl' (1896); 'If I were God' (1897); 'The Romance of Zion Chapel,' a novel (1898); 'Travels in England' (1900); 'Odes from the Divan of Hafiz' (1903); 'Painted Shadows' (1907); 'Little Dinners with the Sphinx' (1909); 'Vanishing Roads and other Essays' (1915).

LE GENDRE DE MONSIEUR POIRIER, lĕ zhändr' dĕ mĕ'zyẽr pwä'ryẽr ('Mr. Poirier's Son-in-law'), is regarded as a model of the modern French comedy of manners and by some as supreme in this class since 'The Marriage of Figaro.' Jules Sandeau (1811–82) furnished the general scheme for it; Émile Augier (1820–89), as is clear from comparison with his other dramas,— it was the 12th of 28 — gave to its social satire the distinctive touch of genius. It appeared in 1854, two years after the French had made Napoleon III emperor by popular election. The play's subject is the conflict in ideals and ethics between the new plutocracy, half-deceived by its own democratic catch-words, and the old aristocracy, proud of its aloofness from the spirit of the times. The immediate mark of satire is the new aristocracy of wealth, which had first gained social recognition in the reign of the "bourgeois king," Louis Philippe (1830–48). The millionaire Poirier, a retired cloth merchant, is an aspirant to the peerage. To aid his political and social ambitions he has married his daughter Antoinette to Gaston, a noble, whose debts he has paid and whose idleness he would like to reform. The finer aristocratic qualities are represented in Gaston's friend, Hector, the sturdy virtues of the capitalist class in Verdelet. There is no hero in the play and no villain. Each of the five characters has a winning side. The play develops into a contest in magnanimity, each acting after his kind. Antoinette wins Gaston to active life and to her love. Hector and Verdelet find ground for mutual respect and esteem. The weakness of Poirier's confidence in the power of money to work a change of heart or mind is exhibited with lambent irony, yet he never forfeits a sympathetic interest. Each actor in the domestic drama has gained by contact with every other, has helped and grown in the helping. That is the social moral. The plot is developed with great rapidity and dramatic skill, but the great distinction of the comedy is in its unfolding of character. There are four editions of this drama with English introductions and notes, and a translation by B. H. Clark in 'Four Plays by E. Augier' (New York 1915).

BENJAMIN W. WELLS.

LE GOFFIC, lĕ gŏf'fēk, **Charles Henri**, French poet, novelist and literary critic: b. Lannion, 1863. He made an especial study of the traditions and customs of Brittany, around which most of his work is written. He is a Chevalier of the Legion of Honor and was several times a laureate of the French Academy. He collaborated with Gabriel Vicaire in the writing of the drama 'Le Sortilège' (1896); and with E. Thieulin he published the critical writings 'Nouveau traité de versification française' (1890; 5th ed., 1910). His first volume of verse was 'Armour breton' (1889); 'Le pardon de la reine Anne' (1898); and the first of his collected verse appeared 'Poésies completas' (1913). He contributed extensively to the literature of the European War. Besides the works already mentioned he is author of 'Le crucefié de Keralis' (1892); 'Sur la côte' (1897); 'L'Erreur de Florence' (1904); 'L'Ame Bretonne' (1902–08); 'La double confession' (1909); 'Fêtes et coutumes populaires' (1911); 'Dixmude; the Epic of the French Marines' (Eng. trans., Simmonds, F., 1916); 'Bourguinottes et pompoms rouges' (1916); 'Sans Nouvelles,' drama (produced 1916; pub. 1917); 'Steenstraete' (1917); 'General Foch at the Marne' (1918), etc.

LE JEUNE, lĕ zhĕn', **Paul**, French Jesuit missionary: b. in the diocese of Chalons, 1592; d. Paris, 7 Aug. 1664. He joined the Jesuits in 1614, taught for a time in various colleges and in 1632 was sent to Canada by Richelieu where he became superior of the missions. He founded the Christian Indian village, Sillery, four miles above Quebec, in 1637. He ceased to be superior of the Canadian missions in 1639, returned to France in 1649 and was appointed procurator of foreign missions. He was chosen in 1658 by Anne of Austria for the post of bishop of Canada, but the Jesuits' rules did not permit acceptance of the dignity. Author of 'Briève relation du voyage de la Nouvelle France' (1632), the first of a series of 'Relations' edited yearly by Le Jeune until 1640 and continued by the Jesuits until 1672; he also wrote many devotional books.

LE LOUTRE, lootr, **Louis Joseph**, French missionary: b. about 1692; d. about 1775. He was vicar-general of Acadia, and from about 1740, when he was sent to Nova Scotia, he labored for years among the Micmac Indians of that region with great success, obtaining practical control of all their affairs, spiritual and otherwise. He led them against the English, and when the country fell into the hands of Great Britain succeeded in compelling the Acadians to show their allegiance to King Louis, although for years they had been subjects of King George. The consequence was terrible suffering for the simple people, whose miseries became historic through their deportation in 1755. Le Loutre fled to Quebec, sailed for France, was taken by the English and kept prisoner in the Isle of Jersey for eight years.

Being released, he returned to France, where he died.

LE MENTEUR, lĕ mȯṅ'tĕr (‘The Liar,’ 1642), by Pierre Corneille, is the first good French comedy, the first to emancipate this form of drama from mediæval or misunderstood classical tradition. The liberation came, with the comedy itself, from Spain. This is in part translated from ‘La Verdad Sospechosa,’ by Juan de l'Alarcon, though sometimes attributed to Lope de Vega. In part, and especially in the conclusion, it is adapted from it, altered to suit the more refined taste of the France of the aging Richelieu. The hardly less amusing and clever sequel, ‘La Suite du Menteur’ (1643), is taken similarly from Lope. ‘The Liar’ inaugurates in French comedy a class of plays of which Molière's ‘Misanthrope’ is the most notable member, in which interest is centred on the exhibition of some particular social type. The action passes at Paris, opening in the Tuileries and soon passing to the Place Royale, where it closes. The time is contemporary. Dorante, the Liar, having played with the study of law at Poictiers, has just returned to Paris, “abandoning the gown for the sword,” and relying on his tongue and ready fancy to make himself king of hearts. Cliton, his valet, with no greater scruples, has the alert shrewdness and caution of his experience and station and is a worthy predecessor of Molière's Scapin, as Sabine is of the whole tribe of soubrettes. Géronte, the Liar's father, is his easy dupe. Clarice, whom he would have liked to beguile, as well as her friend, Lucrèce, with lying tales of adventures, extravagances and devotion, but whose heart is already given to Alcippe, so turns the tables upon him that he finds himself at last, after a series of scenes hilarious for the auditors, constrained to accept the betrothal with Lucrèce which his father has arranged, as he supposes, at his son's behest. ‘La Suite du Menteur’ tells how Dorante “leaves the lady and takes the money,” but “exchanging fetters of the law for those of marriage” finds his mate and match in Mélisse, while Lucrèce is united, briefly, with the rich and moribund Géronte. ‘Le Menteur’ is edited with English notes by J. B. Segall (New York 1902).

Benjamin W. Wells.

LE MOINE, lĕ moin', **Sir James MacPherson**, Canadian historian: b. Quebec, 24 Jan. 1825; d. Quebec, 5 Feb. 1912. He was educated in his native city and in 1850 was called to the bar. He was inspector of the inland revenue district of Quebec 1869–99. He was knighted in 1897. Among his works are ‘L'Ornithologie du Canada’ (1860); ‘Etude sur les Navigateurs Arctiques Franklin, McClure, Kane, McClintock’ (1862); ‘The Tourist's Note-Book’ (1870); ‘Quebec: Past and Present’ (1876); ‘The Scot in New France’ (1880); ‘Picturesque Quebec’ (1882); ‘The Land We Live In’ (1891); ‘Legends of the Saint Lawrence’ (1898); ‘Annals of the Port of Quebec’ (1900); ‘The Avi-Fauna of the Province of Quebec’ (1902).

LE MOYNE, Antoine, ăṅ-twăn le-mwăn, Sieur de Châteauguay, French soldier and colonist in America: b. Montreal, 17 July 1683; d. Rochefort, France, 21 March 1747. He was a son of Charles Le Moyne (1626–85) (q.v.). He entered the French army and in 1704 came to Louisiana with a company of settlers. In 1705–06 he fought under D'Iberville against the English, in 1717 was appointed commandant of the French forces in Louisiana and in 1718 king's lieutenant of that colony. With the aid of Indians he captured Pensacola from the Spanish 14 May 1719; but he surrendered it 7 August. Having been held as a prisoner of war until July 1720, he took command at Mobile upon the conclusion of the peace of that year, but returned to France in 1726. He was governor of Martinique in 1727–44, and in 1745 was appointed governor of Ile Royale (Cape Breton), but illness prevented him from taking up office.

LE MOYNE, Charles, Sieur de Longueuil, French settler, soldier and proprietor in America: b. Dieppe, France, 1626; d. Villemarie, Canada, 1685. He came to Canada in 1641, settled at Villemarie and was interpreter between the Hurons and the colonists. In 1651 he successfully defended the fort from an attack by the Iroquois, whom he routed with great slaughter; and in 1653 he concluded a peace with the Five Nations. These Indians, however, in 1655 again made an attack upon the colony, which was saved from destruction largely by Le Moyne's exertions. In 1657 Le Moyne received from François de Lauzon, who held 60 leagues of land under royal grant, full seignorial rights; and in 1664 his possessions were largely increased by the cession of Isle Saint Hélène and other tracts. He participated in the expedition led by Tracy and Courcelles in 1666–67, and in several campaigns against the Iroquois; and for many years was captain of Montreal. He was made Sieur de Longueuil in 1668 and to this title that of Châteauguay was later added.

LE MOYNE, Charles, 1st Baron de Longueuil, French soldier in America: b. Villemarie, Canada, 10 Dec. 1656; d. 8 June 1729. He was a son of Charles Le Moyne (q.v.). He entered the French army, with which he served in Flanders, but returned in 1683 to Canada. He promoted colonization in Canada and built a stone fort on his estates at Longueuil. In the campaign of 1687 against the Iroquois he was commander of a division of militia; and in 1690 he was wounded at the repulse of Phipps' attack on Quebec. He was made baron 1700 for services to the colony; commanded the Canadian forces at Chambly, when the English made an unsuccessful attempt to take Montreal; and in 1711 became commander-in-chief of the colonial troops. He was governor of Three Rivers 1720–24 and governor of Montreal 1724–29. In 1726 he rebuilt Fort Niagara.

LE MOYNE, Jacques, Sieur de Sainte Hélène, French soldier in America: b. Villemarie, Canada, 16 April 1659; d. Quebec, October 1690. He was a son of Charles Le Moyne (q.v.). In March 1686 he accompanied the expedition led by the Chevalier de Troyes against the English on Hudson Bay, and in the capture of Forts Rupert, Monsipi and Quitchitchonen, and the seizure of the English governor, took a prominent part. He was second in command of the expedition that captured, plundered and burned Fort Corlear (now Schenectady), 9 Feb. 1690. In October

Phipps laid siege to Quebec and Le Moyne was selected to direct the defense. He was mortally wounded while leading about 200 troops in the repulse of 1,300 British at the passage of the Saint Charles.

LE MOYNE, Jean Baptiste, Sieur de Bienville, French administrator in America: b. Villemarie, Canada, 23 Feb. 1680; d. Paris, 1768. He was a son of Charles Le Moyne (q.v.). In 1729, upon the death of his brother, Charles, Baron de Longueuil (q.v.), he succeeded to the title; but he was known as De Bienville. In 1697 he served in the expedition of the Chevalier de Troyes against the English settlers in Hudson Bay. He afterward went with his brother, D'Iberville (see Iberville), to France, and 24 Oct. 1698, sailed from Brest in the expedition led by D'Iberville to take possession of the mouth of the Mississippi. Bienville was appointed lieutenant of the king, explored the surrounding region, and in 1700 became commander of a fort on the river 44 miles above its mouth. He succeeded Sauvolle in the direction of the colony and assumed command of the camp of Biloxi, 22 Aug. 1701. In December he transferred the settlement to Mobile, which prospered through the arrival of recruits from France with supplies (1703–04) and of 50 Canadians (1706). In February 1708 he was ordered to France as a prisoner, but he was later reinstated in his position. The attempt to cultivate the soil by Indian labor having been unsuccessful, he suggested to the king in 1708 the importation of negroes from the Antilles, to be exchanged for Indians at the rate of three Indians for two negroes. In 1713 Cadillac arrived as governor, and Bienville was commissioned lieutenant-governor. Bienville led an expedition to the territory of the Natchez Indians in 1716, built a fort and concluded a treaty. In 1718 he became governor of Louisiana, in the same year founded New Orleans, which was made the seat of government in 1723; in 1724 he went to France to answer charges preferred against him, but in 1733 returned as governor and holding the rank of lieutenant-colonel. After unsuccessful campaigns against the Chickasaws in 1736, 1739 and 1740 he sailed for France in 1743.

LE MOYNE, Joseph, Sieur de Sérigny, French soldier in America: b. Villemarie, Canada, 22 July 1668; d. Rochefort, France, 1734. He was a son of Charles Le Moyne (q.v.). He entered the French navy and in 1694 and 1697 commanded the flotilla which co-operated with his brother D'Iberville (see Iberville) in the expedition to seize Hudson Bay. Later he received command of a squadron, took to Louisiana Canadian settlers and surveyed (1718–19) the coast of that colony. He drove the Spaniards from their fortifications at Pensacola (15 June 1719), and repulsed them at Dauphin Island, near Mobile (19 August); became a captain in 1720 and in 1723 rear-admiral. From 1723 he was governor of Rochefort.

LE MOYNE, Paul, Sieur de Maricourt, French soldier in America: b. Villemarie, Canada, 15 Dec. 1663; d. there, 21 March 1704. He was a son of Charles Le Moyne (q.v.). He participated in Troyes' expedition against the English at Hudson Bay, was wounded in the attack on Fort Monsipi (20 June 1686) and remained with his brother D'Iberville (see Iberville) in command of the captured district until 1690. In 1690 he distinguished himself in the defense of Quebec against Phipps, later took part in Frontenac's expedition against the Iroquois and in 1701 concluded peace with them.

LE MOYNE, Paul Joseph, Chevalier de Longueuil, French soldier in America: b. Canada, 17 Sept. 1701; d. France, 12 May 1778. He was the son of Charles Le Moyne (q.v.). He entered the French army in 1718. He commanded at Fort Frontenac, and also served as governor of Detroit and Three Rivers. He fought with distinction in various campaigns, and in 1747 marched 180 miles in the depth of a severe northern winter to reinforce Vaudreuil at the siege of Fort George.

LE MOYNE, Pierre. See Iberville, Pierre Le Moyne Sieur d'.

LE MOYNÉ, Simon, Jesuit missionary: b. Beauvais, 1604; d. Cap de la Madeleine, Canada, 1665. In 1622 he entered the Society of Jesus and was sent to Canada in 1638. He was on the Huron mission with Bressani, Chaumonot and the future martyrs. He was a perfect master of the Huron-Iroquois language and was unequalled in his knowledge of Indian customs and traditions. This ability was recognized and he was employed on delicate and arduous embassies. He was the first European to go among the Onondagas and his eloquence and knowledge of their traditions won their admiration. He next was sent to the Mohawks and was well received by them, visited New Amsterdam and pacified the Mohawks during several critical periods. At these times he was often in danger of death. In 1661 he returned to the Mohawks for the fifth time, was tortured and condemned to death, but was saved by the chief, Garakontié. He died on the way to return to the Onondagas. Consult Campbell, 'Pioneeer Priests of North America' (New York 1908).

LE NÖTRE, or **LE NOSTRE,** lĕ nô'tr'. **André,** French landscape gardener: b. Paris, 1613; d. there, 1700. He was the son of the superintendent of the gardens at the Tuileries. He studied painting under Simon Vouet and frequented the studio of Le Brun, later studied architecture and eventually adopted landscape gardening as a profession. The position of his father enabled him to put into effect in the Tuileries gardens some of his ideas and he was later commissioned to plan the gardens of the Chateau de Vaux. He was the originator of the formal French garden with its stately co-ordination of grounds and buildings. He was commissioned director of the royal gardens by Louis XIV in 1657. The park of Versailles is regarded as his masterpiece and he also laid out the gardens of Saint-Cloud, Fontainebleau, Chantilly and many others in France. He was ennobled by Louis XIV in 1675. His influence was felt in many countries and he planned many gardens and parks in both England and Italy. The gardens of the Vatican are his work as is Saint James' Park in London.

LE PÊCHEUR D'ISLANDE, lĕ pā'shẽr dīz'lănd', 'The Iceland Fisherman,' is the most admired novel of Pierre Loti. The author passed most of his life on the ocean, becoming finally and remaining to the close of his active career a commandant in the French navy. He thus came to know the sea in all its aspects and moods. His books describe life on the ocean and in distant countries. The 'Pêcheur d'Islande' alone would suffice to prove that Loti knows not only the ocean, but the human heart as well. The views of Breton life are pictured by the hand of a master with just enough local color to create an "atmosphere" and to explain the characters as far as they are the product of environment. Even if we have never known those who go down to the sea in ships, we come rapidly to know and respect them as we read these pages of beautiful yet solemn description and narrative. We feel the dumb anguish of the bereaved widows and the astonished grief of the orphans. Few love stories of greater delicacy have ever been told than that of Gaud, the heorine, and Yann, her sweetheart. After six days of marriage, he has to go away to the fishing grounds of Iceland, and never returns.

RAYMOND WEEKS.

LE PLAY, lĕ plā, **Pierre Guillaume Frédéric,** French engineer and economist: b. La Rivière Saint-Sauveur (Calvados), 11 April 1806; d. Paris, 5 April 1882. He was educated at the Ecole Polytechnique and was later appointed to a position in the State Department of Mines. He became head of the permanent committee of mining statistics in 1834, and engineer-in-chief and professor of metallurgy at the Ecole des Mines in 1840, receiving the appointment as inspector in 1848. He was designated as organizer of the exhibition of 1855 by Napoleon III, and was later counsellor of state and commissioner-general of the Exhibition of 1867. He was also a senator of the empire. He received the Montyon prize of the Academy of Sciences and was elected grand officer of the Legion of Honor. He was deeply interested in living conditions among the working classes and for many years devoted his vacations to travel in European countries for the purpose of making observations on the subject. He founded the Société internationale des études pratiques d'Économie sociale in 1856 and edited its journal, *La Réforme Sociale,* which he founded in 1881. Author of 'Les Ouvriers européens' (1855); 'La Réforme sociale' (2 vols., 1864; 7th ed., 3 vols., 1887); 'L'Organisation de la familie' (1871); 'La Constitution de l'Angleterre' (in collaboration with Delaire, 1875).

LE PLONGEON, lĕ plŏṅ'zhŏṅ', **Augustus,** French archæologist: b. Jersey, Channel Islands, 1826; d. 13 Dec. 1908. He was a descendant of De Tocqueville, was educated in France and engaged in the practice of medicine in Central America, where he became interested in the history of the Peruvians and conducted investigations which are of recognized value, Author of 'Sacred Mysteries among the Mayas and the Quiches, 11,500 Years Ago' (1886); 'Queen Móo and the Egyptian Sphinx' (1896).

LE QUEUX, lĕ kū, **William,** English novelist: b. London, England, 2 July 1864. He studied art in Paris. In 1888 was a Parliamentary reporter for the London *Globe,* and its sub-editor 1891–93. In 1900 he was appointed English consul to San Marino. He has traveled widely in Europe and the Near East, and is recognized as an authority on the spy systems of Continental Europe. Among his numerous fictions are 'Guilty Bonds' (1890); 'Sinned Against' (1891); 'The Great War in England' (1892); 'Stolen Souls' (1894); 'Whoso Findeth a Wife' (1897); 'The Day of Temptation' (1897); 'Scribes and Pharisees' (1898); 'Wiles of the Wicked' (1900); 'In White Raiment' (1900); 'The Tickencote Treasure' (1902); 'The Invasion' (1908); 'The Hand of Allah' (1914); 'German Spies in England' (1915); 'Britain's Deadly Peril'; 'The Way to Win' and 'The Zeppelin Destroyers' (1916).

LE ROSSIGNOL, lĕ rôs'ĭ-nyôl, **James Edward,** American educator: b. Quebec, Canada, 24 Oct. 1866. He was graduated at McGill University, Montreal, in 1888 and also studied at Leipzig, where he obtained the degree of D.Ph. in 1892. He was professor of psychology and ethics at Ohio University 1892–94, and professor of economics at Denver 1894–1911. In 1908–09, while on leave of absence from Denver, he was professor of economics at the University of Nebraska. In 1911 he was appointed head of the department of economics at the latter institution, and became director of the School of Commerce there in 1913. He was special lecturer at McGill University in 1900 and at the University of Wisconsin in 1903. From August to December 1906 he was in New Zealand investigating economic conditions there. He is a member of the American Academy of Political and Social Science and other societies and has published 'The Ethical Philosophy of Samuel Clarke' (1892); 'Monopolies Past and Present' (1901); 'Taxation in Colorado' (1902); 'History of Higher Education in Colorado' (1903); 'Orthodox Socialism' (1907); 'Little Stories of Quebec' (1907); 'State Socialism in New Zealand' (1910); 'Jean Baptiste, A Story of French Canada' (1915) and numerous articles on economic subjects.

LE ROUGE ET LE NOIR, lĕ roog' ā lĕ nwär ('Red and Black') is, with the 'Chartreuse de Parme,' written at the same time (1830) but published eight years later, the chief title to fame of that original French gentleman of letters, Henri Beyle, who preferred to call himself Stendhal and pass for an Italian. The somewhat enigmatical title of the novel symbolizes the contrasted careers of the army and the Church, between which the coolly and selfishly calculating ambition of the hero chooses. This hero, Julien Sorel, was an early superman, wholly unmoral, recognizing no other measure of the value of conduct than its success in attaining its immediate ends. He appealed strongly to the thoughts and imaginations of a later generation, and we discover expressions of admiration for him in Nitzsche and frequent traces of resemblance to him in the novel. In a romantic age, passionately in love with the color and costume and wonder of far lands and unfamiliar periods of history, Stendhal in 'Le Rouge et le Noir' focussed the attention of the novel upon life under present conditions. The novelist, he said, should hold a mirror up to life as it passes on the street. In his attitude and his method he thus anticipated the realism that was to dominate the novel, and 'Le Rouge et le Noir' is a kind of landmark in the history of the novel in France. Consult English translations by E. P. Robins

(London 1896); and H. B. Samuel (London 1914).' A useful source of information is Adolphe Paupe, 'Histoire des œuvres de Stendhal' (Paris 1903).

ARTHUR G. CANFIELD.

LE SUEUR, Jean François, lĕ swėr, zhŏṅ frăṅ-swä, French composer: b. Drucat-Plessiel, near Abbeville, 15 Jan. 1760; d. Paris, 6 Oct. 1837. At six he was placed at the musical school of the cathedral of Amiens and after completing his studies was made director of music in the cathedrals at Séez, Dijon, etc., and in 1784 in the church of the Innocents, Paris. In 1786 he became master in the church of Notre Dame. He was afterward induced to compose for the theatre, 'Telemachus,' his first opera, being given with great success in the Théâtre Feydeau. From 1788 he devoted his time altogether to theatrical music. His opera 'La Caverne' was produced in 1793; 'Paul et Virginie' in 1794; 'Télémaque' in 1796; 'Les bardes' in 1804, and 'La Mort d'Adam' in 1809. He was made professor of music in the National Institute. In 1813 he became a member of the fourth class of the Institute; in 1814 composer to the king; and in 1817 professor of composition to the Conservatoire. His sacred music consists of 33 masses, and of oratorios and motets. He also wrote several works on musical subjects.

LEA, lē, **Henry Charles,** American author: b. Philadelphia, 19 Sept. 1825; d. 1909. He was a son of Isaac Lea, grandson of Mathew Carey, and was named for his uncle, Henry Charles Carey. He entered his father's publishing house in 1843; became its head in 1865; and retired from business in 1880. He was actively engaged in public undertakings for civil and social advancement, and during the Civil War rendered conspicuous services in support of the Federal government. Between 1840 and 1860 he wrote many papers on chemistry and conchology, and after 1857 devoted his attention to European mediæval history. He had taken up this study as an avocation, but in later years he devoted himself increasingly to the mastery of mediæval church history. He employed copyists to duplicate for him documents dealing with the Inquisition. He bequeathed his books and manuscripts to the University of Pennsylvania. He was a member of the American Academy of Arts and Letters and a Fellow of the British Academy. He received honorary degrees from Harvard, Princeton, Pennsylvania and Giessen. His chief works are 'Superstition and Force' (1866); 'An Historical Sketch of Sacerdotal Celibacy in the Christian Church' (1867; 3d ed., 2 vols., 1907); 'A History of the Inquisition of the Middle Ages' (1888; new ed., 3 vols., 1906; French trans. by Solomon Reinach, 1899; German trans., 1905–06); 'Chapters from the Religious History of Spain' (1890); 'Formulary of the Papal Penitentiary in the Thirteenth Century' (1892); 'A History of Auricular Confession and Indulgences in the Latin Church' (1896); 'The Moriscos of Spain: Their Conversion and Expulsion' (1901); 'History of the Inquisition of Spain' (4 vols., 1906–07); 'The Inquisition in the Spanish Dependencies' (1908). Consult Baumgarten, P. M., 'Henry Charles Lea's Historical Writings' (New York 1909); Cheyney, E. P., "On the Life and Works of Henry Charles Lea," in 'Proceedings' of the American Philosophical Society (Philadelphia 1911).

LEA, Homer, American soldier and author: b. Denver, 17 Nov. 1876; d. Los Angeles, 1 Nov. 1912. He came of a Virginian colonial family and was educated at the University of the Pacific and at the Leland Stanford, Jr., University. He became interested in Chinese military affairs and in 1900–01 he attempted the relief of the Chinese emperor Kwang Hsu. He raised and commanded the second army division in China in 1904, receiving rank as lieutenant-general. He was associated with the Chinese reformer, K'ang Yu-wei; and with Dr. Sun Yatsen in the Chinese revolution, 1911–12. He caused wide comment by the publication of his book 'The Valor of Ignorance' (2 vols., 1909) in which he set forth the possibilities of a Japanese invasion of the United States. He was also author of a novel 'The Vermilion Pencil' (1908); a drama 'Crimson Spider' (1909), and 'The Day of the Saxon' (1912), the latter second of a trilogy of which 'The Valor of Ignorance' was the first volume, and embodying a warning of supposed dangers besetting the British Empire. Lea was also engaged in the preparation of a 'History of the Political Development of the Chinese' at the time of his death.

LEA, Isaac, American naturalist: b. Wilmington, Del., 4 March 1792; d. Philadelphia, 7 Dec. 1886. In early life he engaged in commercial pursuits, and from 1821 to 1851 was partner in a large publishing business; but from boyhood he was devoted to the study of natural history, and his various collections of minerals and fossils, and especially of shells, were valuable contributions to science. He was a member of the Academy of Natural Sciences of Philadelphia, and of the Philosophical Society of the same city, in whose 'Transactions' many of his observations were published; he was also elected to membership in learned societies abroad. His work in the study of fresh-water and land mollusks brought him special distinction. His principal publications are 'Observations on the Genus Unio' (1827–33); 'Synopsis of the Family of Naiads' (1852–70). In the National Museum at Washington his vast collection of *Unionidæ* and his gem collections are deposited. Consult Scudder, 'Bulletin U. S. National Museum, No. 23' (Washington 1885). An account of Lea's work in conchology was published at Philadelphia in 1861 by G. W. Tryon, Jr.

LEA, Luke, American journalist and legislator: b. Nashville, Tenn., 12 April 1879. He was graduated from the University of the South in 1899 and from Columbia University in 1903. He established himself in the practice of law at Nashville in 1903, and later became publisher and editor of the *Nashville Tennesseean.* He served in the United States Senate in 1911–17.

LEA, Matthew Carey, American chemist: b. Philadelphia, 1823; d. there, 15 March 1897. His work in developing the chemistry of photography has served important purposes. Besides many articles treating of the chemical action of light, his publications include an authoritative 'Manual of Photography' (2d ed., 1871). He was the eldest son of Isaac Lea (q.v.).

LEACH, lēch, **Arthur Francis**, English historian and educator: b. London, 1851; d. 28 Sept. 1915. He was educated at New College, Oxford, and was a Fellow of All Souls College in 1874–81. He became a barrister at Middle Temple in 1874 and assistant charity commissioner in the Endowed Schools Department in 1884. He was commissioner from 1906 until his death. He was appointed administrative examiner of the Board of Education in 1901 and became assistant secretary of the board in 1903. He was an authority on the history of education in England. He contributed the articles on the history of education and English public schools to the 'American Cyclopædia of Education' (1912–13). Author of 'English Schools at the Reformation (1546–48)' (1896); 'History of Winchester College' (1899); 'Early Yorkshire Schools' (1899–1903); 'Schools of Mediæval England' (1914), etc.

LEACH, William Elford, English naturalist: b. Plymouth, 1790; d. Palazzo, Saint Sebastiano, near Tortona, 25 Aug. 1836. He studied medicine at Saint Bartholomew's Hospital, London, and took his M.D. at Edinburgh University in 1812. His interest in natural history induced him to abandon medicine and in 1813 he was appointed assistant librarian at the British Museum. He introduced and developed there the natural system of arrangement in conchology and entomology devised by Latrielle and Cuvier, and when his arrangement was superseded by that of the French naturalist, Henri Milne-Edwards, Leach was acknowledged as an investigator to whom science owed great obligations. In the field of crustacea he was considered the greatest naturalist of his time. Ill health compelled his retirement in 1821 after his becoming assistant keeper of the natural history department in the British Museum. He was elected a Fellow of the Royal Society in 1817. Besides numerous contributions to scientific journals and to the 'Encyclopædia Britannica' and 'Edinburgh Encyclopædia' he was author of 'Zoological Miscellany' (3 vols., 1814–17); 'Systematic Catalogue of the Specimens of the Indigenous Mammalia and Birds that are preserved in the British Museum' (1816); 'Synopsis of the Mollusca of Great Britain,' published posthumously (1852).

LEACOCK, lē'kōk, **Hamble James**, American missionary: b. Cluff's Bay, Barbados, 14 Feb. 1795; d. Sierra Leone, Africa, 20 Aug. 1856. He was educated at Codrington College, Barbados, took deacon's orders in 1826, and became assistant priest of Saint John's parish, where he aroused great opposition by freeing his own slaves and offering to all slaves within the parish the privileges of the church. Subsequently he was stationed at Saint Vincent, and was pastor of Saint George's, Charlestown, and at Nevis. He removed in 1835 to Lexington, Ky. From 1836 he held various pastorates, in 1848–55 was again in Barbados, and in 1855 went to Africa as the first volunteer of the West Indian Church Association for the furtherance of the Gospel in West Africa. He developed a large mission field at Rio Pongas, Sierra Leone. Consult the biography by Caswall (1857).

LEACOCK, Stephen Butler, Canadian author and educator: b. Swanmoor, Hants, England, 30 Dec. 1869. He came to Canada in 1876, was educated at Upper Canada College and the University of Toronto, where he was graduated in 1891. After spending several years in school teaching he took a graduate course in political economy at the University of Chicago and was appointed to the staff of McGill University in 1901. Under an appointment by the Rhodes Trust (1907–08) Professor Leacock made a lecture tour round the British Empire. In 1900 he married Beatrix, daughter of Col. R. B. Hamilton of Toronto, and has one son, Stephen Lushington Leacock, b. 19 Aug. 1915. Professor Leacock is the author of 'Elements of Political Science' (1906); 'Essays and Literary Studies,' and of several works of a lighter character, such as 'Nonsense Novels' (1911); 'Sunshine Sketches of a Little Town' (1912); 'Behind the Beyond' (1913); 'Adventures with the Idle Rich' (1914); 'Further Foolishness' (1916); 'The Hohenzollerns in America' (1919).

LEAD, lĕd, or **LEADE**, Mrs. **Jane (Ward)**, English mystic: b. County of Norfolk, 1623; d. Stepney, 19 Aug. 1704. She came of an excellent family and at 16 is said to have heard a miraculous voice during the Christmas festivities in her father's house, after which time she devoted herself seriously to religion. She was married in 1654, widowed in 1670, and thereafter lived in seclusion in London with her only daughter. Her inclination toward mysticism was accentuated by her study of the works of Jacob Boehme, and in April 1670 she began her spiritual diary in which she recorded her frequent prophetic visions. The diary was published in two volumes, 'The Heavenly Cloud' (1681) and 'The Revelation of Revelations' (1683). In 1693 one of the books was translated into Dutch and German by Fischer of Rotterdam and attracted considerable attention. Francis Lee, a young Oxonian traveling in Holland, was induced upon his return to England to make Mrs. Lead's acquaintance and urge her to further writing. Lee was deeply influenced by her sincere piety, became her secretary and after being adopted as her son married her daughter. Lee wrote many of Mrs. Lead's works at her dictation, and was instrumental in the organization of a society of theosophists called the "Philadelphians," of whom Mrs. Lead was the head, and whose membership included many followers throughout England, Holland and Germany. Mrs. Lead's closing years were clouded by poverty and jealousies among her followers, one of whom, however, granted her a small annuity. She died in one of the almshouses of Lady Mico at Stepney. Lee, who remained faithful to her, wrote a description of her death, 'The Last Hours of Jane Lead,' which was translated into German. During Mrs. Lead's lifetime her voluminous writings enjoyed a wide vogue but they are now rare. She wrote also 'Enochian Walks with God' (1694); 'The Laws of Paradise' (1695); 'A Fountain of Gardens' (4 vols., 1696–1701); 'A Living Funeral Testimony' (1702), etc.

LEAD, lĕd, S. D., city in Lawrence County; on the Chicago and Northwestern and the

Chicago, Burlington and Quincy railroads, about 18 miles from the western boundary of the State. It was settled in 1876 and incorporated in 1877. It is situated in the Black Hills in a gold mining region. The chief industries are connected with mining, the manufacturing of mining tools and the outfits for mining camps. Modern methods of mining have made the Black Hills one of the largest gold producing regions in the world, and Lead receives its share of the industrial plants connected with preparing the ore for market. The educational institutions are the public and parish schools, Black Hills Business College, the Hearst Free Kindergarten, and the Hearst Free Library. The Lead Coliseum and several churches are among the prominent buildings. The value of the business transacted annually is about $17,000,000. The government is now managed on the commission plan. Pop. 9,321.

LEAD, one of the most useful metallic elements, well known in chemistry and in the arts. From early times references to it are found in literature. It is mentioned in Exodus xv, 10; Numbers xxxi, 22; Job xix, 24; and Ezekiel xxvii, 12, and is supposed to have been imported into Palestine from Tyre, although it should be remembered that there are lead mines in Sinai and the Lebanon, as well as in Egypt. Articles made of lead by the ancient Romans, such as water-pipes, water-tanks, weights, rings and small ornamental cylinders, are still preserved. Examples in the grounds of old churches show that the Roman method of making pipes from sheet-lead continued in use till late in the Middle Ages. Small lead-weights of curious forms have been found among Viking remains dating as early as the 10th century. Many of the European countries are known to have produced lead as early as from the 10th to the 14th century.

Physical Properties.— Lead (chemical symbol Pb, from the Latin name of the element, *plumbum,* atomic weight about 207), is a soft metal of a bluish-white color, tending to gray, with a bright metallic lustre when newly cut or melted. It is tasteless but has a distinctive odor when rubbed. It soon tarnishes when exposed to the air, taking on a thin film supposed to be suboxide. But lead suffers less than most metals either from atmospheric agencies, or damp soils. It can be scratched with the nail, and easily cut and makes a mark upon paper. Its specific gravity varies from 11.352 in the ingot to 11.365 when rolled into sheets. It begins to melt at 619° F., and is completely liquid at 638°. Its boiling point is about 2,700°. In cooling from a molten condition lead crystallizes into regular octahedrons from which the still liquid lead may be poured away. It may also be obtained in a crystalline tree-like formation known as arborescent lead by decomposing a solution of lead acetate by the electric current. Its hardness is increased by repeated meltings. It is highly malleable and in a less degree ductile, but its tenacity is small— a wire 1-12th of an inch being unable to carry a load of 20 pounds. Lead is not a good conductor of heat or electricity. It can be welded at ordinary temperatures by pressing two freshly cut surfaces together; and when gently heated it can be forced by pressure through perforations and pipes. Water containing carbonic acid has a slight action on lead, carbonate being formed and dissolved, but this action is apparently hindered by the presence of some salts and accelerated by others. When lead is heated to redness in air it is oxidized, litharge (PbO) being formed. Lead is attacked by nitric acid and by hot strong sulphuric acid, but dilute sulphuric or hydrochloric acids have but little action. It is, therefore, largely used for the construction of sulphuric acid chambers and for chemical works plants. It alloys readily with many metals.

Lead Ores.— Native lead occurs sparsely in some localities in Mexico, India and Wales. Its ores are found extensively, more or less pure or associated with other ores, in various parts of the United States, in Great Britain, Germany, Spain and other European countries. The most common form is the sulphite (PbS), known as galena. It occurs usually in veins, and is often associated with zinc and frequently with silver. Ores of lead are found most plentifully in rocks belonging to the Silurian Age, chiefly in the mountain limestones. Some occurrences are true veins, others beds or pockets. In the United States the most common occurrence is as a "sheet" filling a vertical crevice, and is in such cases generally a very pure galena. The lead-silver ores of the Cœur d'Alene district in Idaho are in the form of veins, while those of the Leadville district in Colorado occur largely as irregular replacement deposits of great size in limestones. In both the above districts, the ores are believed by some authorities to have been introduced by heated waters connected with igneous activity. Others argue that the absence of other hot water sedimentary substances make this theory untenable. In the Flat River district of southeastern Missouri, the ores carry little silver, and occur as irregular disseminations in Cambrian dolomites. They are believed to have been introduced by cold waters which leached the ores from adjacent rocks where they occurred in minute quantities. In the Joplin district of Missouri and in southwestern Wisconsin, considerable lead is associated with the zinc ores (q.v.). Cerussite, the lead carbonate, is common in the upper parts of certain lead deposits, where it is supposed to have resulted from the weathering of the galena of the original ore.

In the United States the richest ores are found chiefly in the Western States, the carboniferous limestone bearing both hard and soft ores, which contain silver chloride and cerussite. The output of smelting works in Colorado, Idaho, Missouri, Montana, Utah, etc., figures largely in the industrial statistics of the country. (See LEAD INDUSTRY, AMERICAN). At the present time the main supply of lead is obtained from the Rocky Mountain regions, where the ores are argentiferous — as to some extent all galena is — and the lead-silver mines in some of the States mentioned have produced much wealth for their owners. Conde lead is imported into the United States from British Columbia and Mexico. Other minerals associated with galena are anglesite or sulphate of lead, lanarkite, which is a basic sulphate, pyromorphite, or phosphato-chloride of lead, and bournonite, consisting of the sulphides of lead, copper and antimony. Galena is very heavy and usually can be easily separated from most of the lighter minerals with which it is associated. The heavier minerals, such as barytes, pyrites and blende, are not so easily or completely separated. In Great Britain the ore is crushed to pass through about a half-inch sieve and is dressed to contain over 76 per cent of lead. In other countries the concentration is not so high and sometimes no dressing is resorted to. This is specially the case in districts where the blast furnace is used for smelting, since finely divided material is unsuited for the blast-furnace.

Metallurgy.— Galena is the principal lead ore employed for the purposes which metallurgy (q.v.) now so widely subserves. The next important ores, the sulphate and the carbonate, are seldom treated except in combination with others. The three main processes are the air-reduction, the roasting and carbon reduction and the iron or precipitation reduction processes. Galena when taken from the mine is broken up into small pieces or reduced to powder, and the impurities, in so far as these can be removed mechanically, separated by machines. If the dressed galena is nearly pure, as it often is, the smelting operation is simple. The processes of lead-smelting — galena being the ore — which have grown up in various parts of the world, are strikingly similar in principle, though differing much in detail. Since 1913 flotation has been extensively resorted to for the concentration of lead ores. It is estimated that in 1915 its process recovered not less than 50,000 tons of metal formerly lost in fines and slimes. In the United States lead is smelted in reverberatory furnaces made of brick, or in water-jacketed blast-furnaces. The blast-furnace is always preferable to the reverberatory where it can be used, and has now become almost universal for lead-smelting.

Production.— The latest complete figures available for the world's production of lead are those of 1913; the outbreak of the European War in 1914 demoralized the mining industries of all European countries. The world's total of lead produced in 1913 was 1,270,458 tons. Of this, the United States produced 411,878 tons — 32.4 per cent of the whole. The output of the other lead-mining countries was as follows: Spain, 223,767 tons; Germany, 199,627 tons; Australia, 127,867 tons; Mexico, 68,343 tons; Belgium, 55,997 tons; Great Britain, 33,620 tons; France, 30,864 tons; Austria-Hungary, 26,565 tons; Italy, 23,920 tons; Greece, 20,282 tons; Canada, 18,849 tons; Turkey in Asia, 15,322 tons.

The output of lead in the United States for 1915 was 550,055 short tons, valued at $51,705,000. Of the whole, Missouri produced 195,634 tons; Idaho, 160,680 tons; Utah, 106,105 tons; Colorado, 32,352 tons; Nevada, 7,664 tons; Arizona, 6,953 tons; California, 5,606 tons; Montana, 4,853 tons; Oklahoma, 4,346 tons; Wisconsin, 2,632 tons; and Kansas, 1,320 tons. The lead produced by Missouri, Montana, Oklahoma, Wisconsin and Kansas is non-argentiferous, or what is known as "soft lead." In 1915 the United States imported 76,757 tons of lead of which 47,123 tons came from Mexico, 2,710 tons from South America and 1,150 tons from Canada. In the same year the lead exports of the United States included 26,547 tons to Canada; 13,445 tons to Japan; 11,549 tons to Russia; and 10,603 tons to Great Britain. The output of lead in the United States in 1916 is placed at 552,228 short tons; in 1917, 640,000 short tons.

Lead Oxides.— Five oxides of lead are known, namely, the suboxide (Pb_2O), the monoxide (PbO), the sesquioxide (Pb_2O_3), the red oxide (Pb_3O_4), and the peroxide or dioxide (PbO_2). Of these, however, only three — the monoxide, the red oxide and the dioxide — are of any importance. Lead monoxide (PbO), litharge, or massicot, is largely used in the arts, and is made by heating molten lead in a shallow reverberatory furnace with free access of air, the litharge as it forms being pushed to one side so as to expose a fresh surface of the metal. The mass thus obtained is ground and separated from intermixed lead. It is then the buff-colored powder known as ground litharge or massicot. When the oxidation takes place above the melting point of the oxide, as in cupellation, the litharge on solidification breaks up into orange-colored scales and is then known as "flake litharge." Litharge melts at about 600° C. to a clear liquid, and at higher temperatures volatilizes. Lead oxide is a powerful base and dissolves in acids forming salts. At high temperatures it combines readily with silica, forming fusible silicates, and therefore has a very corrosive action on crucibles or firebricks which contain silica. An electrolytic process of making red lead and litharge from galena is used at Niagara Falls. When litharge is heated to dull redness with free access of air, oxygen is taken up and the red oxide (Pb_3O_4) red lead is formed. It is manufactured by roasting ground litharge with free access of air for about 24 hours; the operation being carried on till the required tint is obtained on cooling. It is used as a pigment and in the manufacture of flint glass and enamels.

Compounds of Lead.— One of the most important lead compounds is plumbic carbonate (carbonate of lead, white lead), $PbCO_3$ — the cerussite of mineralogists, and now largely mined in the United States as an ore of lead. White lead is manufactured on a large scale, and is extensively used in the arts as a white pigment and as a body for other colors in paints. (See PAINTS). Another leading compound is plumbic chloride (chloride of lead), $PbCl_2$. The minerals matlockite and mendipite are both oxychlorides of lead. A basic chloride of lead is made for use as a white pigment, which is, however, not so serviceable as ordinary white lead. Lead acetate (sugar of lead), $Pb(C_2H_3O_2)_2$, $3H_2O$, is prepared by dissolving massicot in dilute acetic acid. It can be obtained in transparent crystals or in scales by evaporating the solution. It is soluble in one and one-half parts of cold water, and in eight parts of alcohol. Like litharge, it is used in the manufacture of oil-varnishes. Minium or red lead is much used in the manufacture of flint-glass, as a cement and as a pigment. For glass-making it requires to be made of very pure lead as a slight trace of copper would impart a color to the glass. Minium is prepared by heating massicot or monoxide of lead to a temperature of 600° F. in iron trays, in an oven, carefully avoiding fusion. More oxygen is thus gradually absorbed; and a bright-red compound is formed which is the red lead of commerce. Orange lead, made from white lead instead of from massicot, is a very pure kind of red lead. Yellow lead, so called sometimes by manufacturers, is a mixture of the oxides of lead and antimony, which is to some extent used to give a yellow color to earthenware, and as a pigment. The so-called black lead (see GRAPHITE), of which pencils, etc., are made, contains no lead.

Lead in Medicine.— Most of the lead compounds used in medical practice are made into external applications for disorders of the system which manifest themselves upon the skin, although some are employed as sedatives, astringents, etc. Lead acetate is an approved internal remedy in typhoid fever, diarrhoea and other diseases. Of plasters, ointments and the like, lead carbonate, lead iodide and lead oleate are familiar constituents.

Lead Poisoning.— Under the influence of moist air, or of water in which air is held in suspension, the hydroxide of lead is formed, and this is soluble in water. To this condition is to be attributed many cases of poisoning by drinking water which has been standing for some time in lead pipes or vessels. The use of soluble salts of lead in the arts is a frequent cause of painful and sometimes fatal poisoning, from the metal finding its way into the system. The effects often are not immediate as minute doses are apparently harmless, but these being oft repeated have a cumulative effect and the seizure is sudden. The glazing of culinary vessels with lead; the coloring of confectionery with the chromate, chloride or carbonate of lead; the sweetening of sour wine by litharge or oxide of lead; the drinking of water which has passed through new lead-pipes; and living much in rooms newly painted with lead-colors, all these things may cause exposure to this peril, and often produce lead or saturnine poisoning. But the most frequent and virulent cases occur among painters and persons engaged in white-lead factories. In lead-poisoning the countenance assumes a sallow, earthy hue, the skin becomes dry and harsh, the digestion is deranged and the bowels constipated, and a sweetish metallic taste is felt in the mouth. A specially important sign is the appearance of a blue or violet line along the margin of the gums and teeth, due to the formation of sulphide of lead. There is sometimes kidney derangement, muscular palsy, severe disturbance of the brain, and even epilepsy and some form of insanity. The most commonly occurring result of lead-poisoning is lead-colic, or painters' colic. See ELECTRO-CHEMICAL INDUSTRIES; ORE DEPOSITS.

LEAD, Refining of. See ELECTROCHEMICAL INDUSTRIES.

LEAD PENCILS. The earliest mention of what are known to-day as lead pencils appears in records dating back to 1565 — not long after the discovery of the noted graphite mine at Borrowdale, England, in 1554. This mine furnished the material for the first lead pencils. The graphite was sawed into strips and fastened into wooden casings. In 1795 the Frenchman Conté improved the process by grinding the graphite and mixing it with clay, in order to produce grades of hardness and blackness, and this is the method of manufacture at the present day. Not all graphite is available in making pencils. The variety known as «flake graphite» is quite useless, the flaky texture allowing the pencil to slip over the paper without leaving a mark. The variety which is used is a form in fine scales approaching the amorphous form and is found in localities in Siberia, Bohemia and Bavaria in Europe, and in Mexico.

The graphite as it comes from the mine is ground in a mill together with a special kind of clay mined in Germany. This grinding is continued until the mass is perfectly homogeneous. The proportion of clay added is determined by the degree of hardness required in the finished pencil, the very hard (marked HHHHHH) having the most clay and the very soft (BBBBBB) having hardly any. The soft leads have to be made larger in diameter to stand the strain put upon them when in use. After the grinding, the putty-like mass is put into the cylinder of a hydraulic press which has a pierced plate for the bottom and a movable plunger is driven down upon the mass, forcing it through the perforations in the plate. This operation is repeated as many times as it appears necessary to get the paste into a perfectly smooth condition. It is then put into another similar press which has only one perforation in the plate. This may be square, round or oval, depending upon the shape of the lead required. As the «string» of lead comes slowly through the plate an operator guides it into a groove cut in a tray and nips it off into lengths of seven inches. When filled, the trays of leads are covered with carbon dust and placed in an oven where they are baked at a temperature ranging from 2,200° to 2,300° F., to secure just the right degree of hardness.

The wood in which the lead is encased is red cedar from the Southern forests — preferably in Florida, Georgia and Alabama, where the cedar grows with a smooth cheesy texture. This material is milled until it is in «slats» seven inches long, two inches wide and one-fourth inch thick, sufficient for the lower halves of six pencils. In these slats are cut six grooves deep enough to hold a string of lead. The slats are given a coat of glue and the leads are put in place, and a cover slat, slightly thinner, is glued on. The «blocks,» as they are now called, are placed in clamps where they remain until thoroughly dry and hard. Then they go into a shaping machine which mills them into six perfectly shaped pencils, round, hexagonal, oval or any other form for which the knives are set and leaving them perfectly smooth. Then they are fed into a machine which gives them one or two coats of varnish of such a color as desired. The ends are then trimmed, a strip of gold leaf laid on one end which receives the title from another press, the tin tips and rubbers are put on in an automatic machine and the pencils are ready for boxing and labeling for the market.

The supply of cedar has been so rapidly disappearing that an attempt has been made to grow it under cultivation. In 1906 the number of lead pencils made in the United States was about 320,000,000, requiring 110,000 tons of cedar, which was then selling at $20 per ton. Since then cedar buyers in the South have bought up old cabins built of cedar logs, and even replaced old rail fences with wire, in order to get the coveted wood, no other substance having been proved a satisfactory substitute.

The pencils with colored leads go through the same process, except that «China clay» is used as the binder, and colored pigments take the place of the graphite. For these, with their larger «leads,» it has been found feasible to construct a casing of paper wound spirally around the centre. This is glued at one point on each turn, and the pencils are sharpened by unwinding as many turns as are necessary. The glued spots hold the strip from unrolling all the way down. Copying pencils are made with a coal-tar dye mixed with a gum soluble in water. Carpenters' and markers' pencils have a proportion of wax or tallow incorporated with the graphite.

LEAD SOUNDINGS. See Soundings.

LEADER, Benjamin Williams, English landscape painter: b. Worcester, 12 March 1831. He studied art at the Worcester School of Design and at the Royal Academy of Arts, London. He early gained recognition as an able follower of the great English landscape painters and has specialized in the landscapes of western Britain. He has been an exhibitor at the Royal Academy since 1854. He was elected a chevalier of the Legion of Honor in 1889, and won the gold medal at the Paris Exhibition in that year. He was awarded a medal at the Columbian Exposition at Chicago in 1893, and was made a Royal Academician in 1898. Among his paintings are 'The Valley of the Llugwy' (Tate Gallery, London); 'A Quiet Valley Among Welsh Hills' (Worcester Gallery); 'The Weald of Surrey' (1901). Consult Lusk, L., 'Life and Work of B. W. Leader' in *Art Annual,* December 1901.

LEADER, the player who takes the principal part in a musical organization, as the first violin in an orchestra, the first cornetist in a brass band and the first soprano in a chorus. Formerly the leader in bands and orchestras was also the conductor, but the duties are now separated in large organizations. In an orchestra the leader is stationed at the conductor's right, directs the uniform bowing of the violins, and upon him in a large measure rests the animation and precision of «attack.» He also plays all solo violin passages except in concertos. Except in orchestras that are organized institutions he usually makes the engagements with the different members.

LEADHILLITE, a lead ore consisting of sulphate and carbonate with probable formula, $4PbO\ SO_2.\ 2CO_2H_2O$. Found in small amounts in Pinal County, Ariz., and Tintic district, Utah.

LEADING STAR. See Lodestar.

LEADING TONE OR NOTE, in musical compositions the note immediately below the keynote, separated from it by a semitone, the shortest interval in the system. It takes its name from the fact that it leads up to the most important note in the scale, but has no status of its own and is incapable of standing as a root note. In the Greek scales and in the ecclesiastical scales derived from them the note immediately below the keynote was separated by a full tone and was in no sense a leading note. A growing sense of harmony among musicians demanded the use of the leading note, but ecclesiastics were disinclined to permit any change in the scales and Pope John XXII passed an edict against it in 1322. However, musicians usually sang it, and as it was not written the ecclesiastical authorities ignored it. By the time of Bach and Handel lines of difference between the antique and modern scales had become fused and the leading note has since had its recognized place.

LEADING OF VOICES, musical term covering the correct progression of individual voices or parts in a musical composition. See Harmony, Counterpoint.

LEADVILLE, lĕd'vĭl, Colo., a city and the county-seat of Lake County, 80 miles by rail southwest of Denver, the State capital, on the Colorado Midland, Colorado and Southern and the Denver and Rio Grande railroads. It is situated 10,200 feet above the sea amid picturesque scenery, near the headwaters of the Arkansas River in central Colorado, between the Mosquito and Sawatch ranges of the Rocky Mountains. Leadville was first settled in 1860 by miners and prospectors, but after a period of comparative prosperity as a gold-mining centre declined with the exhaustion of the first discovered deposits. It revived with the discovery in 1877 of rich lead and silver deposits, followed by the discovery of other gold, zinc, copper, bismuth and manganese deposits, and the mineral output during the period 1879–1905 amounted to $328,487,146. It is the mining, farming and grazing trade centre of an extensive region, has fine buildings, including a Carnegie library, opera house, theatre, courthouse, jail, hospital and almshouse, has a parochial school, a high school and four grade schools and several churches. The city is lighted by gas and electricity, has an excellent water supply and well-organized fire and police departments. Besides its large sampling, refining and reduction works, smelting furnaces, etc., it has also iron foundries, manufactures of machinery, ice, jewelry and novelties and a government fish-hatchery. The city is administered by a mayor and common council of six members elected biennially. Pop. 7,500.

LEAF, Walter, English classical scholar and financier: b. Norwood, 1852. He was educated at Trinity College, Cambridge, where he was a Fellow in 1875. He entered the banking firm of Leaf, Sons and Company in 1877 and was its chairman after its reorganization as Leaf and Company, Ltd., in 1888–92. He was one of the founders of the London Chamber of Commerce, serving successively as its vice-president, deputy chairman and in 1887 chairman. He was president of the Hellenic Society in 1914, and his researches in classical literature gained for him additional degrees from Cambridge and the D. Litt. from Oxford. He was chairman of the London County and Westminster Bank in 1914 and was appointed to the committee of finance for the European War. Author of numerous contributions to periodical literature of the classics and of 'The Story of Achilles' (1880) with J. H. Pratt; 'The Iliad, Edited with Introduction and Notes' (2 vols., 1886–88; 2d ed., 1900–02); 'Companion to the Iliad' (1902); 'Troy: a Study in Homeric Geography' (1912); 'Homer and History' (1915). He also translated from the Russian 'A Modern Priestess of Isis' (1894), and published 'Versions from Hafiz: An Essay in Persian Metre' (1898).

LEAF. See Leaves.

LEAF-BEETLE, a popular name for many members of the family *Chrysomelidæ* (q.v.), which embraces about 18,000 widely distributed species, about 600 of which are found in North America. The larvæ, which feed upon the succulent parts, either fully exposed, in protective cases, beneath the epidermis as leaf-miners or stalk-borers, are all soft-bodied six-footed creatures with great appetites. Some larvæ feed on roots, some are aquatic and many cover themselves with excrement as a protection against their enemies. The adults of several tropical species are of such brilliant colors as to be used for jewelry when mounted in gold settings. The family includes many species considered serious pests of cultivated plants. Some of the most noted of these are the flea-beetles, tortoise-beetles, potato and asparagus beetles, elm-leaf beetle and the diabroticas, represented by the striped and the spotted cucumber-beetle. These are treated under their food-plant titles.

LEAF-BUG, or **PLANT-BUG,** bugs of the family *Capsidæ,* which suck the juices of plants. Two hundred and fifty of the thousand or more species described occur in the United States, and all except the predaceous species are vegetable feeders, a few being considered pests. They are generally oval or elongated, yellowish or greenish, sometimes with lines or dots of red or black. All have a decidedly "buggy" odor. Among the best-known species are the red-bug or cotton-stainer (*Dysdercus suturellus*), so called because its excrement stains the cotton in the opening boll, thus reducing the grade. It is less troublesome than formerly because the piles of cottonseed in which it used to breed are now used for oil instead of being thrown in heaps to decay. The insect also attacks oranges in Florida. Cottonseed will attract them away from the trees. Another species troublesome on currants, gooseberries, dahlias, etc., is the four-lined leaf-bug (*Pœcilocapsus lineatus*). Its eggs are laid in the young twigs which may be cut in autumn or winter and burned. The insects may also be jarred off the plants into receptacles while sluggish in the early morning.

LEAF-CUTTER BEE, one of the large bees of the genus *Megachile,* of which a common species in the United States is *M. centuncularis.* It is a "thick-bodied bee with a large square head, stout scissors-like jaws and with a thick mass of dense hairs on the under side of the tail for the purpose of carrying pollen." These bees make their nests in the hollow stems of elder-bushes, or, nowadays, often in crevices about buildings, and form their cells of round pieces which they cut out of tender leaves of many sorts of trees and bushes, especially the rose. Many cells are made, each containing an egg and store of pollen, and the whole economy of the group is very interesting. There are many species in various parts of the world.

LEAF-CUTTING ANTS. See Ants.

LEAF-FROG, a small American frog of the family *Cystignathidæ* and the genus *Hylodes,* common in the tropics. They are similar to the tree-toad, are usually prettily colored and in size are rarely quite two inches long. The fingers as well as the toes have effective sucking discs enabling them to climb trees and perch securely upon their branches. The vocal sac of the male is similar to that of the tree-toads. The most common species is the *Hylodes martiniensis,* the coqui of the West Indies, noteworthy because of its being the first established instance of the complete metamorphosis of the young frog before leaving the egg.

LEAF-HOPPER, any member of the family *Jassidæ,* which includes a very large number of small bugs greatly varying in form and often grotesque. They are especially numerous in grass and grain, which they are believed to injure to a greater extent than is usually supposed. Among the best-known species is the grape-vine leaf-hopper (*Erythroneura vitis*), which is often so abundant in vineyards that the leaves may turn brown from the insects' punctures. They have been effectively caught by tapping the vines to make the insects jump against a screen smeared with tar or a fan similarly covered and kept in constant motion close to the vines. This species is sometimes erroneously called "thrips" (q.v.). Among the best known of the grass-feeding host of species is the destructive leaf-hopper (*Cicadula* or *Limotettix exitiosa*). This is sometimes caught in wide pans covered with tar and dragged across the field.

LEAF-INSECT, or **WALKING LEAF,** tropical species of the family *Phasmidæ,* which is represented in temperate climates by the walking-stick (q.v.). They are so called because of the remarkable resemblance of their wings to leaves, not only in color but also in the arrangement of the veins, etc., so that the natives believe that the insects are really leaves which have acquired organs of locomotion, digestion, etc. Their legs also look more or less like twigs, and their eggs, which are dropped upon the ground from the foliage where the insects feed, look very much like seeds. When leaf food fails these insects eat one another's wings. This likeness is of use as a protection from enemies. See Mimicry in Animals.

LEAF-MINER, any insect of the superfamily *Tineoidea,* which comprises several families of very small moths, most of whose larvæ feed upon the soft tissues (parenchyma) of leaves and green stems beneath the epidermis, sometimes eating away rounded passages and sometimes long serpentine paths. More than 4,000 species have been described, of which fully 1,000 are American. The adults are often remarkably beautiful, exhibiting under the microscope a covering of lustrous scales. Among the plants that these insects attack injuriously are oaks, pines, maples and palmettos. Some of the leaf-feeding species have developed the habit of feeding during their later larval days upon the outside of the leaf, either fully exposed or in a protective case. Others have assumed root- and seed-feeding habits; still others have become twig-borers and gall-formers. Some of the related species live upon animal skins, fur, wool, etc. (See Clothes-Moth). A few flies of the families *Anthomyiidæ* and *Oscinidæ* are leaf-miners, as are also some leaf-beetles of the family *Hispini* and some sawflies of the family *Tenthredinidæ*. Consult Comstock, J. H. and A. B., ‘Manual for the Study of Insects’ (8th ed., Ithaca, N. Y., 1909); Sharp, ‘Cambridge Natural History’ (Vol. VI, London 1901).

LEAF-MONKEY, an Anglo-Indian name for a langur (q.v.).

LEAF-NOSED BATS, a general term for such bats as have on the snout upright leaf-like growths of highly sensitive membrane which is presumably of great assistance to them in making their way about in darkness and in finding and taking their insect-prey. (See BAT). These folds of skin are, naturally enough, called the nose-leaf, and may be comparatively small and simple, or so large as to form a grotesque mask, such as gives so extraordinary appearance to the horse-shoe and other leaf-nosed bats of the family *Rhinolophidæ*, and to the «false vampires» of the family *Nycteridæ*. North American bats show very little of this peculiarity. These complicated membranes are always fringed with long fine hairs, which serve the purpose of the tactile whiskers of cats, and the bats possessing this feature are more thoroughly nocturnal than those in which it is lacking or little developed.

LEAF-ROLLER, LEAF-TYER, or **LEAF-SEWER**, a small moth, in most cases one of the family *Tortricidæ*, whose caterpillar rolls a leaf or a part of a leaf into a case, tying it into a cylindrical case with silken bands and lining this case with silk, so as to form a sort of cocoon in which it may transform safely into the pupa stage. In some cases the nest is formed by fastening together several leaves. «In most cases,» says Comstock, «the building of the nest is the work of a single larva, but in very many instances several larvæ work to build a common nest.» Each species makes its nest of a particular form, and infests some special kind of plant or tree, and many do considerable injury, especially among greenhouse plants and orchard trees.

LEAF-TYER. See LEAF-ROLLER.

LEAGUE, lēg, a measure of length varying in different countries. The word is supposed to be of Celtic origin, but it has been introduced into the modern languages of Latin origin through the Latin *leuca*. The Romans derived it from the Gauls. It was brought to England by the Normans and at that time (1066) equalled 2.9 modern English miles. The Roman league was equal to 1,500 paces, each of 5 feet, or 1.376 modern English miles. The English land league is 3 statute miles and the nautical league 3 equatorial miles, or 3.457875 statute miles. The Italian league is reckoned as equal to 4 miles, each of 5,000 feet. The Spanish league varies very much according to the locality. On the modern Spanish roads the league is estimated at 8,000 varas, or 7,416 English yards. The Portuguese league was equal to 3.84 English miles. In the old French measures the length of the league was different in every district, but the three principal leagues were the legal or posting league, equal to rather less than 2½ English miles, the marine league somewhat more than 3½ English miles and the astronomical league equal to about 2¾ English miles. The metric league is reckoned as equal to 4 kilometres (2.49 miles). At present the league is a nautical measure equal to the 20th part of a degree, that is, 3 geographical miles, or 3.657 statute miles.

LEAGUE, political connections which have been called *alliances* since the French language has become the diplomatic language of Europe. Among these are the League of Cambrai, formed in 1508 between Louis XII, king of France, the German Emperor Maximilian and Ferdinand of Spain, for the purpose of humbling the republic of Venice, and which was joined in 1509 by Pope Julius II. This league was dissolved in 1510, as many similar ones have been, in consequence of mutual distrust, and was succeeded in 1511 by the *liga santa*, or holy league, between the Pope, Maximilian, Ferdinand and Venice. The object of this was to compel Louis XII, whose allies had now become his enemies, to renounce his conquests in Italy; which object was gained. Thirty years afterward a holy league was formed in Germany. When the principal Protestant princes in Germany united in 1530, and again in greater numbers in 1536, to form the union of Schmalkalden, in order to protect their common faith and withstand the Emperor Charles V, the Roman Catholic princes assembled at Nuremberg, in 1538, to take measures for the support of their own faith and to oppose the designs of the Protestant princes; and as their league had the protection of the Roman Catholic Church for its object, they termed it the *holy league*. A fourth league was headed by Henry, Duke of Guise, in 1576, against Henry III of France. Its ostensible object was the support of the Roman Catholic religion, whence it was called the Catholic League. There was a fifth league in Germany in the 17th century known as the Holy League.

LEAGUE AND COVENANT. See COVENANTERS.

LEAGUE OF NATIONS. See NATIONS, LEAGUE OF.

LEAGUE OF THE PRINCES, a league formed under the leadership of Frederick the Great, 12 July 1785, between Prussia, Hanover and the electorate of Saxony against Emperor Joseph II of Austria, for the purpose of defeating Austria's project of annexing Bavaria, giving in exchange Belgium. The league was afterward joined by Brunswick, Mainz, Hesse-Cassel, Baden, Mecklenburg, Anhalt and the Thuringian Lands. It accomplished its purpose and continued its existence until the death of Frederick the Great, when it was dissolved as no longer necessary.

LEAGUE OF THE PUBLIC WEAL, a union of powerful French nobles under the leadership of Charles the Bold, Duke of Burgundy, against Louis XI for the purpose of regaining their old feudal rights which had been largely usurped by the king. The league's victory at Montlhéry, 16 July 1465, resulted in the signing of the Treaty of Conflans, in which Louis was forced to concede the demands of the nobles. Subsequently, however, Louis succeeded in dealing individually with the members of the league with the result of re-establishing the power of the throne over that of the feudal chiefs.

LEAHY, lē'hĭ, **William Augustine,** American author: b. Boston, 18 July 1867. He was graduated from Harvard in 1888, was literary editor of the Boston *Traveller* in 1893–94, then entered general literary work and contributed verse and short stories to magazines. From 1902 he was secretary to the music department of the city of Boston, until 1910, when he became secretary to the mayor of Boston 1910–12. His works are 'The Siege of Syracuse' (1889); 'The Incendiary' (1896), which obtained a prize offered by the Chicago *Record;* and a 'History of the Catholic Church in New England' (1899).

LEAKE, Sir **John,** English admiral: b. Rotherhithe, 1656; d. Greenwich, 21 Aug. 1720. He entered the navy and in 1673 was serving under his father on board the *Royal Prince.* He became commander of the *Firedrake* in 1688 and served under Admiral Herbert in the action off Bantry Bay, 1 May 1689. His achievement of setting fire to the French ship *Diamant* in that action secured his promotion to the command of the *Dartmouth* with 40 guns. He convoyed supply ships to Londonderry with the *Dartmouth* and succeeded in raising the siege. He commanded the 70-gun *Eagle* in the battle of Balfour, 19 May 1692, and in 1701 he was appointed governor and commander-in-chief at Newfoundland. He achieved the purpose for which he was sent out, the destruction of the French fishing fleets and settlements on that coast, and upon his return to England was promoted rear-admiral of the fleet. In 1702 he was knighted and promoted vice-admiral. He relieved Gibraltar in 1704 and again in 1705. He was made vice-admiral of the white in 1704. In 1706 he risked disobedience to orders and succeeded in relieving Barcelona, but the wisdom of his action was so clear that he received no reprimand. Later in the year he secured the surrender of Cartagena, Alicante, Majorca and Iviza and upon his return to Portsmouth he was presented by the queen with a present of £1,000. He became admiral of the white and commander-in-chief of the Mediterranean in 1707 and captured a large fleet of the enemy's victualers with which he averted the famine which threatened Barcelona as a result of the French victory at Almanza. He later participated in the reduction of Sardinia and Minorca and in 1709 he became rear-admiral of Great Britain. He was appointed one of the lords of the admiralty in 1709, acting as chairman of the board. He was member of Parliament from Rochester in 1708–14. Upon the death of Queen Anne his appointments and patents expired and he was retired on a pension of £600. Consult Leake, S. M., 'Life of Sir John Leake' (1750); Campbell, 'Lives of the Admirals' (Vol. III).

LEAKE, lēk, **William Martin,** English archæologist and topographer: b. London, 14 Jan. 1777; d. Brighton, 6 Jan. 1860. An officer in the West Indian service (1794–98) and artillery instructor at Constantinople in early life, he later traveled in the East and was engaged in surveys and diplomatic business for the British government in Greece (1805–09). Among his publications are 'Researches in Greece' (1814); 'Topography of Athens' (1821), a learned and still valuable work; 'Historical Outline of the Greek Revolution' (1826); 'Travels in Northern Greece' (1835); 'Peloponnesia' (1846). Consult Marsden, 'Brief Memoir of the Life and Writings of W. M. Leake' (1864).

LEAMINGTON, Canada, village in Essex County, Ontario, on Lake Erie and on the Michigan Central and Père Marquette railroads, 30 miles southeast of Windsor. The village has connection with Windsor by electric railroad and there is steamship connection with Pelee Island. It has trade in country produce, lumber and tobacco and its industries include canning, sash and blinds and tobacco factories. Pop. 2,652.

LEAMINGTON, or **LEAMINGTON PRIORS,** England, fashionable health resort in Warwickshire, on the river Leam near its junction with the Avon, 98 miles northwest of London, on the Great Western and London and Northwestern railroads. The town owes its importance to its springs of mineral waters, saline, sulphurous and chalybeate. There are baths and a fine building houses the pump-rooms. The town is modern, dating its growth from the erection of the baths about 1786. Its population in 1811 was only 543 and it was not incorporated until 1875. In 1838 it received a royal license to call itself Royal Leamington Spa, but the name never became popular. There are several important schools, a college, a handsome town-hall which houses an art gallery and public library, the South Warwickshire Hospital and Midland Counties Home for Incurables and extensive public gardens and parks. Leamington and Warwick, two miles distant, have from 1885 formed a constituency sending one member to Parliament. Aside from its business as a health resort the town has iron foundries and brickworks. Pop. 26,713.

LEANDER, Saint, bishop of Seville: b. Cartagena, 534 or 550; d. Seville, 13 March 600 or 601. He early entered a Benedictine monastery and afterward founded a school which became famous. He converted Prince Hermenegild, eldest son of the Gothic King Leovigild, to Catholicism and was exiled. He spent the years 579–82 in Byzantine where he gained the friendship of the future Pope Gregory the Great, with whom he afterward maintained a correspondence. He returned to Seville and about 584 was created bishop. He converted Reccared, second son and successor of Leovigild, and succeeded in securing Visigothic's Spain's rejection of Arianism for the Roman Catholic faith. Pope Gregory dedicated to him his 'Moralia in Jobum' and in 599 sent him the pallium.

LEANDER CLARK COLLEGE, before 1906 known as Western College, is located at Toledo, Iowa. It was founded by the Iowa Conference of the United Brethren in Christ; was incorporated in 1856; and was opened to students in 1857. It was first located at Western, Linn County, but was moved to Toledo in 1881. In 1889 the main building was destroyed by fire, but was immediately rebuilt. The board of trustees consists of representatives of the alumni and of five conferences of the United Brethren and three members-at-large. The college is open to men and women on equal terms. Two regular college courses are offered, the classical and the scientific, and the degrees of A.B. and B.S. are conferred. Both courses are almost entirely elective in the last two years, the list of electives differing in the two courses. In addition to the collegiate department, there are the Academic or Preparatory School, the Conservatory of Music, the College of Commerce, the School of Elocution and Oratory and the Department of Art. Graduates from the collegiate courses are admitted to the senior year of Yale, Chicago and Smith without examination. The buildings include the main building, the Bright Conservatory of Music, Mary Beatly Hall (the dormitory for young women), Drury Hall (the young men's dormitory) and the College Church. The faculty number 16 instructors; the average annual attendance of students is 240; tuition fees amount to $65; living expenses, board, etc., $162; productive funds are $203,000; income, including tuition and incidental charges, $21,663; the graduates since organization number 617. The library contains 7,500 volumes.

LEANDER AND HERO. See HERO.

LEANDER McCORMICK OBSERVATORY. The Leander McCormick Observatory of the University of Virginia owes its origin to the generosity of the late Leander J. McCormick of Chicago. The chief instrument is the 26-inch refractor, both lens and mounting the work of Alvan Clark and Sons. The lens when finished was the largest in the world and it was regarded by Alvan G. Clark to be his masterpiece. While testing it, before its erection at the University of Virgina, the star τ Cygni was discovered to be a double. The observatory was opened in 1882. The first director was Ormond Stone. The work under his direction was entirely visual and investigations were carried out along the following lines: A study of the Orion nebula, a search for southern nebulæ, micrometer measures of double stars, satellites and comets, photometric work by means of a wedge and observations of long period variables by the Argelander method. S. A. Mitchell succeeded Professor Stone in 1913. A double-slide plate holder was attached to the eye end of the telescope and photographic work was undertaken, using a color filter and isochromatic plates. The chief work at present is the determination of the parallaxes of the fixed stars by means of photography. The parallaxes of 125 stars were found as the result of two and a half years' work. Photographic work is also done by placing a wire grating in front of the objective. This work is for the purpose of determining the photovisual magnitudes of the Harvard standard regions and is being carried on in co-operation with Harvard College Observatory. The McCormick Observatory is the headquarters of the American Meteor Society. In 1916 more than 10,000 observations on meteors or shooting stars were made in the United States and Canada, and largely by amateur astronomers. These observations are sent to the McCormick Observatory and are discussed by Dr. Charles P. Olivier and the results published. The work on long period variables has been continued. On account of the large aperture (26-inch) stars are visible near their minima and when they are invisible to the telescope at Harvard and to the smaller telescopes used by the American Association of Variable Star Observers. Micrometer work on doubles, etc., has likewise been continued. There are three fellowships available for graduate students who wish to continue work for the degree of doctor of philosophy. The income of the observatory is derived from appropriations by the University of Virginia, by gifts from the Leander McCormick estate and from Mr. Edward D. Adams of New York and by small grants from the National Academy of Sciences for meteor research.

LÉANDRE, lā'än'dr', **Charles Lucien,** French caricaturist and painter: b. Champsecret, Orne, 1862. He studied under Bin and Cabanel and made his first exhibition at the Salon in 1887. He specialized in portraits and genre painting and was also a teacher of drawing until 1894 when he began the publication in *La Rire* of the drawings and caricatures which made him famous. He was also connected with *Le Figaro* and other journals. His portraits in pastels constitute a considerable success in another branch of art and his lithographic work is ranked as exceptional. He illustrated Rostand's 'Cyrano de Bergerac' (1900); and Murger's 'Vie de Bohème' (1903). Among his posters may be mentioned 'Yvette Guilbert'; 'Les nouveaux mariés'; 'Joseph Prudhomme'; 'Les Lutteurs'; and 'La Femme au chien.' He published a series of albums; 'Nocturnes'; 'Le Musée des souverains'; 'Paris et la province.' He was created a chevalier in the Legion of Honor in 1907.

LEANING TOWER. See PISA.

LEAP YEAR, the name given in Great Britain to every year of 366 days. The length of the year is a little less than 365¼ days. Julius Cæsar, in reforming the calendar, arranged that in every fourth year February should have 29 days instead of 28, and that two days should be called by the same name. The day whose name was repeated was, according to the Roman method of reckoning, the sixth before the calends of March, that is, the 24th February, and the year in which this name was given to two successive days was named *bissextile* (*bis*, twice; *sextus*, sixth). The name leap year is perhaps due to the notion that the calendar takes a leap of one day every fourth year to make up for its ordinary year being one-fourth day too short. Every year is a leap year which is divisible by four without remainder, except the concluding years of centuries, every fourth only of which is a leap year; thus the years 1800 and 1900 are not leap years, but 2000 and 2400 are.

LEAR, lēr, **Edward,** English author and artist: b. London, 12 May 1812; d. San Remo, 29 Jan. 1888. In 1831 he became draftsman to the London Zoological Society. His illustrations of the 'Family of the Psittacidæ' (1832) was followed by many other illustrations for zoological works by Gould, Bell, Swainson, Jardine and Gray. In 1837 he visited Italy and the East and in those parts spent most of his remaining days, chiefly occupied with landscape painting. He exhibited 'Dead Birds' in 1836 and in 1850 was represented at the Royal Academy exhibition by 'Claude Lorraine's

House on the Tiber.› As an author he is best known by his ‹Book of Nonsense› (1846); ‹Nonsense Songs and Stories› (1871); ‹More Nonsense Songs,› etc. (1872); and ‹Laughable Lyrics› (1877). He also wrote ‹Views in Rome and its Environs› (1841); ‹Illustrated Excursions in Italy› (1846); ‹Journal of a Landscape Painter in Greece and Albania› (1851); ‹Journal of a Landscape Painter in Southern Calabria› (1852); ‹Views in the Seven Ionian Islands› (1863); and ‹Journal of a Landscape Painter in Corsica› (1870). Tennyson's verses ‹To E. L. on his Travels in Greece› were addressed to Lear.

LEAR, Tobias, American diplomatist: b. Portsmouth, N. H., 1762; d. Washington, D. C., 11 Oct. 1816. He was graduated at Harvard in 1783 and in 1785 became private secretary to General Washington, to whose domestic affairs he attended for several years, and by whom, in his will, Lear was most liberally remembered. In 1802 he was consul-general at San Domingo and afterward consul-general at Algiers and commissioner to conclude a peace with Tripoli. He discharged this last duty in 1805 in a manner which gave offense in certain quarters, but his conduct was approved by the Federal government. He returned shortly after to the United States.

LEAR OF THE STEPPES, A (‹Stepnoy Korol' Lir›). A number of Turgenev's friends. in 1870, were giving reminiscences of Shakespearean characters whom they had met in life. Turgenev gave his story of the Russian King Lear, in which he meant to depict the elemental passions, as found in the rude Russian surroundings. Tall, awkward, harsh Kharlov, a landed proprietor, who in reality possesses the soul of a simple-minded child, has two daughters, who slavishly execute his will, but are waiting for his death. Having had an ominous dream about death, he makes his property over to his daughters. Immediately they turn him out of his home, and when a street urchin taunts him with his homelessness, he is seized with the passion for revenge. He ascends the roof of his house, and with his gigantic strength pulls it to pieces, until he falls dead among the ruins. The younger daughter is seized with remorse and joins the dissenters, among whom, through her imperious manner, she assumes a leading position. The elder sister grows prosperous as a landlady. Where, then, is the poetic justice? Has she deserved her good luck? To this question Turgenev gives the significant answer that everything in the world, both the good and the bad, takes place according to a logical law, which man cannot comprehend, but which he (Turgenev) seems dimly to grasp.

LEO WIENER.

LEARNED, lär'nĕd, **Marion Dexter**, American educator: b. near Dover, Del., 10 July 1857; d. 1 Aug. 1917. Graduated from Dickinson College, 1880, he studied in Germany in 1885 and received his Ph.D. at Johns Hopkins University in 1887. He was instructor in languages at Dickinson Seminary in 1880–84 and in 1886–95 he was first instructor, then associate professor and professor of German at Johns Hopkins. In 1895 he became professor of German in the University of Pennsylvania. He edited *Americana Germania*, later *German American Annals*, from 1897 and was organizer and director of the American Ethnographic Survey. Besides numerous contributions to periodicals he wrote ‹The Pennsylvania German Dialect› (1889); ‹German Diaries of the American Revolution› (1902–05); ‹The Family of Abraham Lincoln› (1909); ‹Guide to the MS. Sources of American History in the German State Archives› (1912).

LEARNED LADIES, The (‹Les Femmes Savantes›), one of the most readable, vivacious and often acted comedies of Molière, was first produced 11 March 1672 and published in 1673. The theme is related to that of ‹Les Précieuses Ridicules,› but is not the same. The attack there was on literary pretense in a passing vagary of fashionable speech; here it deals with perennial springs of affectation and pedantry. The play has a close modern counterpart in Pailleron's ‹Le monde où l'on s'ennuie.› Its lively raillery at abiding social foibles, ebullient good humor and savory commonsense gave it lasting hold on the stage. It owed immediate success, however, in part to its hardly disguised portraiture of Abbé Cotin, a dilettant literateur, in the character of Trissotin, «Thrice-fool,» as a contemporary interprets the name, which Molière had altered from the too-recognizable Tri-cotin. Whether Vadius, the pretentious pedant of the play, is meant for Boileau's aversion Ménage is disputed. Ménage had at least the wit to recognize no resemblance. Around Trissotin the whole action revolves. Indeed, Madame de Sévigné called the play by his name. The question is whether he shall receive the hand of the very engaging Henriette or whether it shall go with her heart to Clitandre, a fine young fellow with less affectation to learning. But, throughout, the interest is almost wholly in portrayal of character and in the satire of the literary pedantry and affectation which are developed in that contest. Henriette knows her own mind and heart, she lacks neither tact nor resource, but she is a dutiful daughter of her time, country and station. For Trissotin is her mother, Philaminte, masterful in the home and bent on forming a circle of arbiters of taste so that «none shall have wit but ourselves and our friends.» With her is Henriette's aunt Bélise, a sentimental pedant borrowed with little change from Desmaret's ‹Visionnaires,› and her elder sister Armande, an acidulated pedant with a personal grudge against Clitandre. On the other side is her father, Chrysale, acted by Molière, an exceedingly acute study of a man of good sense, good nature but weak character, starting with right impulses, but soon thinking to compromise, and discovering that he has surrendered. Ariste supports Chrysale's better judgment with commonsense, and Martine, the cook, with delicious peasant shrewdness and wit. Legend says the part was studied from Molière's own cook who acted herself in it. Trissotin is at last tricked into revealing that he cares more for Henriette's dowry than for herself, and Clitandre wins the prize. The best remembered scenes of the play are concerned with a sonnet ‹To the Princess Urania on her Fever› and an epigram, both taken bodily from Abbé Cotin's ‹Œuvres galantes,› published in 1663. Cotin had fatuously called himself Father of the French Enigma and had described his monogram, two C's facing one another, as «forming a circle that, in a sense hardly mystic, indicates the circumference of the world to be filled by my works.» These two pieces, at least, have come near to fulfilling the prophecy. Abbé Cotin is remembered for them alone. 'Les Femmes Savantes' is best edited with pertinent comment by Mesnard in Vol. IX, and by Moland in Vol. XI of their editions of Molière. There are editions with English notes by Alcée Fortier (Boston 1902) and others, and translations by H. Van Laun (Edinburgh 1875) and C. H. Page (New York 1908).

Benjamin W. Wells.

LEARNING IN ANIMALS. See Animal Psychology; Eyesight in the Lower Animals.

LEARY, Richard Phillips, American naval officer: b. Baltimore, 3 Nov. 1842; d. Boston, 27 Dec. 1901. He was graduated at the United States Naval Academy in 1860; served during the blockade of Charleston 1863-65; promoted commander in 1882. During the Samoan revolution in 1888 he was the senior naval officer present at the critical moment. He was promoted captain in April 1897; commanded the cruiser *San Francisco* in 1897-98; and when the *New Orleans* was purchased from Brazil convoyed that vessel to the United States. At the close of the Spanish-American War he was appointed the first American governor of Guam and served there till relieved, on his own request, in April 1900.

LEASE, a species of contract granting the possession of lands, tenements, or incorporeal hereditaments, for life or a limited term of years, or during the pleasure of the contracting parties. The grantor is called the lessor and the grantee the lessee. A lease may be in writing or by parol, but the former is more satisfactory, as it usually sets out in regular form and binding terms the respective rights of the contracting parties. In many of the states of the Union the statutes require that leases for more than one year be in writing. A lease contract establishes the relation of landlord and tenant between the lessor and lessee, unless its terms limit the relation of the parties. A lessor who holds an estate for years only may under-lease in such a manner as to establish a technical relation of landlord and tenant between the owner of the fee and the lessee. One of the essential requisites of a lease is that its duration must be for a shorter period than the duration of the interest of the lessor in the property leased; for if the holder of an interest less than that of a fee leases his interest for the full term of its continuance it would be in effect an assignment or sale of his interest and in no sense a lease. In a lease proper, the lessor reserves to himself a reversionary interest in the property included in the lease. The beginning and termination of which are to be determined by the agreement of the parties. This agreement must also include a designation of the premises, estate or interest intended to pass to the lessee. A term, however, is perfected only by the entry of the lessee. Even after the making of a lease the estate remains in the lessor up to such time as the lessee actually enters into possession, and the only right the lessee has in the estate is that of making an entry, which must be exercised to give him the additional rights provided for in the lease. All persons possessed of lands or tenements, or interest therein, competent to do business and under no legal disability, as of unsound mind, immature age or the like, may enter into a lease contract. (See Estate; Landlord and Tenant; Real Property); and consult the authorities referred to under those heads.

LEASE AND RELEASE, a form of conveyance used in England for the transfer of ownership of a freehold and reversion. It is said to have been devised by Sergeant Moore after the enactment of the statute of uses. The instrument is of a compound nature, consisting of a lease, covering the bargain and sale, and providing for a release enacted in separate deeds. The lease provides for the use of the property in question for one year upon payment of a pecuniary consideration by the tenant; at the end of the year the tenant, being in possession, is capable of receiving a release of the freehold and its reversion, which release may be made the following day. This method of conveyance was in use in various parts of the United States until after the Revolution, when it was superseded by conveyance by bargain and sale, and it has since been replaced by similar conveyances in England.

LEASEHOLD. A leasehold is an estate held under or by virtue of a lease. An estate for years usually commences by means of a written lease. It is important to distinguish between a lease and an agreement to lease, the former being a completed contract and the latter only a stipulation for the formation of a contract at some future time. It is often difficult to determine to which of the two classes an instrument belongs, without resorting to an interpretation based upon the intentions of the contracting parties. If a lessee fails or refuses to enter into possession under and in accordance with the terms of a lease, the possession remains undisturbed in the lessor, and the remedy of the latter would be by an action for not entering into possession and for consequent damages, rather than for a breach of the conditions of the terms of the lease, the relation of landlord and tenant not having been established before an entry under the lease. A person can convey by lease no greater interest than he possesses in an estate. If the lessor has only a life estate it terminates with his death, although he may have executed a lease for a term of years not completed at the time of his death. The ordinary powers, duties and obligations of the contracting parties may be increased, diminished or modified by special provisions in a lease. Many lease contracts provide for all of the contingencies which can ordinarily happen. It is not infrequent that a clause in the instrument provides that the lessee may build upon land leased to him, and that he shall have the right to remove his buildings at the expiration of his term, or purchase the fee. Any provision not illegal or inconsistent with public policy may be an incident of a leasehold.

LEAST ACTION, Principle of, the principle, due to Maupertuis and first definitely enunciated by Lagrange, that the sum for all the particles in a given dynamical system of the space-integrals of the moments of these particles as they move from a position P_1 to a position P_2 is in general smaller by the actual route which the particles traverse than by any slightly different route. The sum of the integrals, or Σ *Smvds* is called the *action* of the system, and is represented by the letter A. Even when A is not less than any of its neighboring values, what is known as its first variation is 0. See CALCULUS OF VARIATIONS; MECHANICS.

LEAST SQUARES, Method of. A mathematical process for treating the results of scientific observation so as to free them as far as possible from the effect of error.

The familiar idea of measurements either regards them all as perfectly exact when made, or at least sufficiently near perfect exactness. For instance, a carpenter wishing to know the width of a room simply measures with his two-foot rule, and notes the size just as it came from the measurement. But in scientific work, where the highest degree of accuracy is necessary, we must do much more than this. The carpenter's measurement will doubtless be correct within an inch, and if he is a particularly careful workman, it will be correct within a fraction of an inch. But if it were necessary to know the width of that room within a hundredth of an inch very different processes of measurement and very much more accurate tools would be essential. If it were required to attain a degree of exactness within one thousandth of an inch, it might perhaps happen that no tools or method of measurement could be devised which would accomplish the desired result.

It is obvious on reflection that since human measurements must always depend ultimately upon fallible human senses, so there must always exist a limit of precision beyond which it is not possible to go. It happens almost always that the degree of precision required in scientific measurements is somewhere near this unattainable limit; so that it is especially in scientific work that we have to resort to some method adapted to diminish as far as possible the harmful effects of those small errors which thus always result from the fallibility of human senses. The Method of Least Squares was perfected for this purpose.

It is clear from the above that this method is pre-eminently a practical process; it can perhaps be understood best by approaching it from the point of view of a concrete practical example. For instance, it is well known that a bar of iron changes its length with every change of temperature. If the bar is heated it becomes longer; when cooled it becomes shorter. Now suppose an experimenter in a physical laboratory desires to determine the effect of temperature changes upon the length of such an iron bar. What he does is extremely simple. Apparatus is provided for varying the temperature of the bar by alternate heating and cooling, and additional apparatus for measuring its length very accurately at various temperatures. At the same time some form of thermometer is used to make certain that we know the exact temperature of the bar at the various stages of the experiment.

Let us introduce the following notation:

l_0 = length of the bar at some assumed temperature t_0,

l = length of the bar at some other temperature t.

Now if we are willing to assume that the length varies uniformly with changes of temperature we may write,

x = increase in length of bar per degree of heating.

We shall then have the equation,

$$l = l_0 + (t - t_0)\,x. \tag{1}$$

The quantities appearing in this equation are of three kinds with respect to our knowledge of their numerical values:

1. Unknown quantities; viz.: x and l_0.

2. A quantity known from observation, and therefore subject to errors brought about by the fallible human senses; viz.: l.

3. A coefficient which we may safely assume to be known, with practically complete accuracy from the thermometer readings; viz.: $t - t_0$.

Let us now rewrite equation (1) in a slightly different form, and repeat it several times with subscript numbers, so as to distinguish equations depending on the successive observations at various temperatures. We have:

$$\begin{array}{c} l_0 + (t_1 - t_0)\,x - l_1 = 0, \\ l_0 + (t_2 - t_0)\,x - l_2 = 0, \\ l_0 + (t_3 - t_0)\,x - l_3 = 0, \\ \text{etc.} \qquad\qquad \text{etc.} \end{array} \tag{2}$$

It is at once evident that as we have only two unknown quantities (l_0 and x) we can compute their numerical values from any two equations of the group (2) by the ordinary processes of elimination given in elementary algebras. But which two equations shall we select for this purpose? We might use the first two, for instance, or the last two, or the first equation and the last. If we try the actual process numerically upon a real example we generally find that the values of the unknowns come out different from the various combinations of equations. It was not until the Method of Least Squares was introduced that scientific men had a better way of computing their observations than the crude one of solving a great many different combinations and taking the average of the results so obtained.

The reason for the differences thus arising from different combinations of equations is easy to find. We have seen that the quantities l in equations (1) and (2) are known from observation, and therefore subject to the usual small unavoidable observational errors. If the l's were absolutely correct, all combinations of equations would give precisely the same results for the three unknowns. But the l's are not thus absolutely correct; and, in a very strict sense, the several equations numbered (2) are therefore inconsistent amongst themselves. Admitting fallible numerical values of the l's as actually observed, all equations of the form (2) cannot be exactly true simultaneously: indeed, it follows from the very nature of observational errors such as affect the l's that in all probability no one of the equations (2) is really absolutely correct and true.

The right-hand members of equations (2), then, should not really be zeros. It will be more correct to represent them by a series of small quantities v, and to write equations (2) thus:

$$\begin{array}{c} l_0 + (t_1 - t_0)\,x + l_1 = v_1, \\ l_0 + (t_2 - t_0)\,x + l_2 = v_2, \\ l_0 + (t_3 - t_0)\,x + l_3 = v_3, \\ \text{etc.} \qquad\qquad \text{etc.} \end{array} \tag{3}$$

Formation of Normal Equations.—It will be convenient at this point to introduce a change of notation, so as to secure greater generality, and at the same time avoid our somewhat cumbersome form, which has been employed simply to visualize our conceptions by fixing attention upon an example derived from actual practice. We shall now increase the number of unknown quantities from two to three, and designate them by the lettetrs x, y, z; and the known coefficients of x, y, z we shall designate by the letters a, b, c. The quantities l, observationally known, will now be designated by n's. This will bring our notation into conformity with the usual practice of writers on Least Squares. Our general equation intended for solution thus become, from (3):

$$
\begin{aligned}
&a_1x+b_1y+c_1z+n_1=v_1,\\
&a_2x+b_2y+c_2z+n_2=v_2,\\
&a_3x+b_3y+c_3z+n_3=v_3,\\
&a_4x+b_4y+c_4z+n_4=v_4,\\
&\text{etc.,}\qquad\qquad \text{etc.}
\end{aligned}
\tag{4}
$$

The v's are here simply the errors of the equations, if we may be permitted the use of such an expression. More accurately, they are the amounts by which the equations fail of satisfaction when we substitute in them any assumed system of numerical values for the unknowns x, y, z. If, by any process whatever, we obtain a system of numerical values for x, y, z, and substitute those values in the left-hand members of equations (4), we shall obtain a series of residual errors represented by the v's. The name "residual" has therefore been given to the v's, for brevity.

It is evident that if we consider two different systems of numerical values for the unknowns x, y, z, and substitute both systems in equations (4), we shall get two different sets of values for the residuals v. In fact, and in general, for every different system of values belonging to x, y, z there will be a different set of v's: it is the province of the Method of Least Squares to determine which system of x, y, z, and corresponding v's is preferable. To do this, we make use of the following principle, due to Legendre:

Of all possible systems of values for the unknowns x, y, z, that one possesses the highest probability of being correct which makes the sum of the squares of the residuals v a minimum.

This principle probably does not admit of rigorous demonstration, but it is so highly plausible that we are justified in adopting it without hesitation. This plausibility becomes evident when we consider that the best system of values for x, y, z must certainly make all the individual residuals small. Yet it would not do to adopt as our principle that the sum or mean of the residuals should be a minimum. For some being positive, and some negative, it might happen that the sum or mean would be made very small, while the individual v's remained in part very large. But the squares are not subject to this criticism, since they are all positive, and are at the same time the simplest functions that are thus positive.

Adopting, then, Legendre's principle of Least Squares, it remains to show how we can use it to solve equations (4). Again following the notation usual with writers on this subject, we shall employ square brackets as a symbol of summation, so that, for instance, the quantity

$$[vv]$$

will designate the sum of the squares of all the v's. Then, according to Legendre's principle, we must have:

$$[vv] = \text{a minimum.} \tag{5}$$

But, according to equations (4), $[vv]$ is a function of x, y, z; and as these latter quantities are independent, the principles of maxima and minima in the calculus tell us that we can satisfy the condition (5) by equating separately to zero the first partial differential coefficients of $[vv]$ with respect to x, y, z. In other words, we have:

$$\frac{\delta\,[vv]}{\delta x}=0,\ \frac{\delta\,[vv]}{\delta y}=0,\ \frac{\delta\,[vv]}{\delta z}=0. \tag{6}$$

Now since:

$$[vv] = v_1v_1 + v_2v_2 + v_3v_3 + v_4v_4 + etc.$$

equations (6) become:

$$
\begin{aligned}
&v_1\frac{\delta v_1}{\delta x}+v_2\frac{\delta v_2}{\delta x}+v_3\frac{\delta v_3}{\delta x}+etc.=0,\\
&v_1\frac{\delta v_1}{\delta y}+v_2\frac{\delta v_2}{\delta y}+v_3\frac{\delta v_3}{\delta y}+etc.=0,\\
&v_1\frac{\delta v_1}{\delta z}+v_2\frac{\delta v_2}{\delta z}+v_3\frac{\delta v_3}{\delta z}+etc.=0.
\end{aligned}
\tag{7}
$$

Now, differentiating equations (4), we have:

$$
\begin{aligned}
&\frac{\delta v_1}{\delta x}=a_1, &&\frac{\delta v_1}{\delta y}=b_1, &&\frac{\delta v_1}{\delta z}=c_1,\\
&\frac{\delta v_2}{\delta x}=a_2, &&\frac{\delta v_2}{\delta y}=b_2, &&\frac{\delta v_2}{\delta z}=c_2,\\
&\frac{\delta v_3}{\delta x}=a_3, &&\frac{\delta v_3}{\delta y}=b_3, &&\frac{\delta v_3}{\delta z}=c_3;\\
&\text{etc.,} &&\text{etc.,} &&\text{etc.}
\end{aligned}
$$

so that (7) become:

$$
\begin{aligned}
&a_1v_1 + a_2v_2 + a_3v_3 + etc.= 0,\\
&b_1v_1 + b_2v_2 + b_3v_3 + etc.= 0,\\
&c_1v_1 + c_2v_2 + c_3v_3 + etc.= 0.
\end{aligned}
\tag{8}
$$

It will be noticed that the number of equations of the form (8) is the same as the number of unknown quantities x, y, z, no matter how large may have been the number of original equations of the form (4). We shall therefore simply substitute in equations (8) values of the v's from equations (4), remembering that, according to our notation:

$$
\begin{aligned}
&[aa] = a_1a_1 + a_2a_2 + a_3a_3 + etc.,\\
&[ab] = a_1b_1 + a_2b_2 + a_3b_3 + etc.,\\
&[ac] = a_1c_1 + a_2c_2 + a_3c_3 + etc.,\\
&\qquad \text{etc.,}\qquad \text{etc.}
\end{aligned}
$$

and thus obtain the following equations:

$$
\begin{aligned}
&[aa]x + [ab]y + [ac]z + [an] = 0,\\
&[ab]x + [bb]y + [bc]z + [bn] = 0,\\
&[ac]x + [bc]y + [cc]z + [cn] = 0.
\end{aligned}
\tag{9}
$$

Equations (9) are called "Normal Equations." As we have just seen, their number is always equal to the number of unknown quantities, and their solution by elimination offers no ambiguity. Furthermore, owing to the method by which they have been deduced, it is clear that they will furnish for the unknowns x, y, z a system of numerical values, which, when substituted in the original equations, (4), will make the sum of the squares of the residual errors less than would be the case with any other possible system of numerical values for the unknowns, no matter how much other system might have been obtained.

If we now compare the above normal equations (9) with the original equations (4), which are usually called "observation equations," we see at once the law of formation of (9) from (4). It is evident that to form the normal equations we may use the following simple rule, first writing zeros instead of v's for the right-hand members of equations (4).

Rule for Normal Equations.— To form the first normal equation, multiply each observation equation throughout by the coefficient of its x, and then add the resulting equations. To form the next normal, use in the same way the coefficients of y; and for the third normal, use the coefficients of z.

The normal equations once formed, they can be solved by any method of algebraic elimination; but it is generally most convenient to use the following special form of computation, due to Gauss.

From the first equation (9) we have:

$$x=-\frac{[ab]}{[aa]}y-\frac{[ac]}{[aa]}z-\frac{[an]}{[aa]}.$$

If we substitute this value of x in the other two normal equations (9) we shall eliminate x. This substitution can be systematized by the introduction of auxiliary quantities $[bb.\ 1]$, $[bc.\ 1]$, etc., defined by the following equations:

$$
\begin{aligned}
[bb.\ 1] &= [bb]-\frac{[ab]}{[aa]}[ab],\\
[bc.\ 1] &= [bc]-\frac{[ab]}{[aa]}[ac],\\
[bn.\ 1] &= [bn]-\frac{[ab]}{[aa]}[an],\\
[cc.\ 1] &= [cc]-\frac{[ac]}{[aa]}[ac],\\
[cn.\ 1] &= [cn]-\frac{[ac]}{[aa]}[an].
\end{aligned}
\tag{10}
$$

Using these auxiliaries, the substitution of the above value of x gives:

$$
\begin{aligned}
&[bb.\ 1]y+[bc.\ 1]z+[bn.\ 1]=0,\\
&[bc.\ 1]y+[cc.\ 1]z+[cn.\ 1]=0.
\end{aligned}
\tag{11}
$$

These equations, while precisely similar in form to the original normal equations (9), now involve one less unknown quantity, and their number has been reduced from three to two. A second application of the same method of elimination gives the following "second" auxiliaries:

$$
\begin{aligned}
[cc.\ 2] &= [cc.\ 1]-\frac{[bc.\ 1]}{[bb.\ 1]}[bc.\ 1],\\
[cn.\ 2] &= [cn.\ \ ]-\frac{[bc.\ 1]}{[bb.\ 1]}[bn.\ 1],
\end{aligned}
\tag{12}
$$

and the equation:

$$[cc.\ 2]z+[cn.\ 2]=0. \tag{13}$$

From this equation (13), we have for the value of z:

$$z=-\frac{[cn.\ 2]}{[cc.\ 2]}. \tag{14}$$

We now find the value of y by substituting this value of z in either of the equations (11); and x by substituting the values of y and z in any one of the normal equations (9).

Case of a Single Unknown.— It is of special interest to consider the application of the Method of Least Squares when there is only a single unknown quantity, directly observed. An example of this, for instance, would be our measurement of a room, where the only unknown is the width of the room, and several independent direct observations have been made.

Denoting the single unknown quantity by x, the observation equations of the form (4) will be:

$$
\begin{aligned}
x+n_1&=v_1,\\
x+n_2&=v_2,\\
x+n_3&=v_3,\\
x+n_4&=v_4,\\
&\text{etc.};
\end{aligned}
\tag{15}
$$

and if we suppose there are in all m such observation equations, the "rule for normal equations" gives a single normal equation of the form:

$$mx+[n]=0, \tag{16}$$

and this will be the only normal equation. The solution is:

$$x=-\frac{n}{m}, \tag{17}$$

or, in other words, the most probable value of x is the arithmetical mean of the several observed values represented by the n's. This is a further strong addition to the evidence of plausibility attaching to Legendre's theorem of Least Squares. Possibly no other simple admissible theorem as to the residuals would give this result for a single unknown, observed directly; yet this result is the only one consistent with common sense.

Actual, Mean and "Probable" Errors.— The values obtained for the unknowns by the Method of Least Squares are not the true values, but only the *most probable* values obtainable under the circumstances. They are subject to error; and we shall here consider three different quantities technically known as "errors."

1. The *actual error,* defined as the divergence from the truth, and designated by the symbol Δ.

2. The *mean error,* defined as an error of such magnitude that its square is the mean of the squares of all the actual errors Δ belonging to the several observations. It is designated by the symbol ε. If there are m Δ's,

$$\varepsilon\varepsilon=\frac{[\Delta\Delta]}{m}. \tag{18}$$

3. The *probable error,* whose magnitude is such that it is an even chance whether any random actual error Δ belonging to any observation is bigger or smaller than the probable error. It is designated by r.

To determine the value of ε for the case of a single unknown x, observed m times, we proceed as follows. Let:

x_0 = the arithmetical mean of the observed values of the unknown x, equation (17).

x_0+q the unknown and unknowable true value of x.

Then, as we have seen, x_0 is the most probable value of x, according to the Method of Least Squares, and $[vv]$ will be a minimum if we substitute that value of x in equations (15). This substitution gives:

$$
\begin{aligned}
x_0+n_1&=v_1,\\
x_0+n_2&=v_2,\\
x_0+n_3&=v_3,\\
&\text{etc.}
\end{aligned}
$$

But if, instead of x_0, we substituted the true quantity x_0+q, we should get a series of true errors Δ, instead of the residuals v. This would give:

$$\begin{aligned} x_0+q+n_1&=\Delta_1,\\ x_0+q+n_2&=\Delta_2,\\ x_0+q+n_3&=\Delta_3,\\ &\text{etc.} \end{aligned}$$

A subtraction between these last two sets of equations gives:

$$\begin{aligned} \Delta_1&=v_1+q,\\ \Delta_2&=v_2+q,\\ \Delta_3&=v_3+q, \end{aligned} \tag{19}$$

and there will be m such equations. Squaring and adding them gives:

$$[\Delta\Delta]=[vv]+mq^2+2[v]q.$$

But, from the principle of the arithmetical mean,

$$[v]=0,$$

so that:

$$[\Delta\Delta]=[vv]+mq^2. \tag{20}$$

From the equation of definition (18):

$$[\Delta\Delta]=m\,\varepsilon\varepsilon;$$

so that,

$$\varepsilon\varepsilon=\frac{[vv]}{m}+q^2. \tag{21}$$

Now, the value of q^2 can never be known; but we can get an approximation to it easily enough. It can be shown by the theory of probabilities that if we continue observing any quantity, the mean error of the arithmetical mean of the observed values will decrease in proportion to the square root of the number of observations.

To demonstrate this principle, let us consider:

Two observed quantities, n_1, n_2,
affected with actual errors, Δ_1, Δ_2,
and mean errors, ε_1. ε_2.

Now let N be the sum of n_1 and n_2 or:

$$N=n_1+n_2,$$

and designate by Δ' and ε' the actual and mean errors of N. We shall have:

$$\Delta'=\Delta_1+\Delta_2;$$

and squaring this equation:

$$\Delta'\ \Delta'=\Delta_1\cdot\Delta_1+\Delta_2\ \Delta_2+2\ \Delta_1\ \Delta_2.$$

If k observations have been made to determine n_1 and n_2 the above becomes by summation:

$$[\Delta'\,\Delta']=[\Delta_1\,\Delta_1]+[\Delta_2\,\Delta_2]+2\,[\Delta_1\,\Delta_2].$$

In this equation, the last term, $2\ [\Delta_1\,\Delta_2]$ may be considered zero, because it will disappear, or nearly disappear, in the general average, on account of positive and negative errors being equally probable, a priori. But the squared terms remain, being always positive, and we have:

$$[\Delta'\,\Delta']=[\Delta_1\,\Delta_1]+[\Delta_2\,\Delta_2].$$

Consequently, by our equation of definition (18), this becomes:

$$\varepsilon'\ \varepsilon'=\varepsilon_1\ \varepsilon_1+\varepsilon_2\ \varepsilon_2.$$

This equation brings out the important principle that the square of the mean error of the sum of two quantities is equal to the sum of the squares of their respective mean errors. The principle can of course be extended so as to include three, or any greater number, say m, of observed quantities.

Now let us suppose the n's to have been observed with equal accuracy, so that ε_1 and ε_2 will be equal, and we have:

$$\varepsilon'\ \varepsilon'=2\ \varepsilon_1\ \varepsilon_1,$$

or for m n's:

$$\varepsilon'\ \varepsilon'=m\ \varepsilon_1\ \varepsilon_1,$$

or

$$\varepsilon'=\sqrt{m}\ \varepsilon_1$$

This last equation shows that the mean error ε' of the sum of m equally precise quantities is $\sqrt{m}$ times the mean error of one quantity. But the arithmetical mean of m observations is $1/m$ times their sum, and its mean error therefore ε'/m, or, according to the above:

$$\text{Mean error of arithmetical mean}=\frac{\varepsilon_1}{\sqrt{m}}$$

which establishes the principle enunciated above, that the mean error of the arithmetical mean decreases in proportion as the square root of the number of observations increases.

In accordance with this principle, x_0 will be more accurate than any individual average x in the proportion of $\sqrt{m}$ to 1. Consequently, since q is the error of x_0 and ε a sort of average value for the error of any x, we may take as a good approximation for q^2:

$$q^2=\frac{\varepsilon^2}{m}.$$

Substituting this value of q^2 in equation (21), we get:

$$(m-1)\ \varepsilon\varepsilon=[vv],$$

or:

$$\varepsilon=\sqrt{\frac{[vv]}{m-1}} \tag{22}$$

and equation (22) will enable us to calculate approximately the mean error ε from the known residuals v.

It would carry us too far afield in the theory of probabilities to demonstrate the relations existing between the mean error ε and the probable error r. But we may remark in passing that it is shown in works on the theory of errors, that, approximately:

$$r={}^2/_3\,\varepsilon,$$

or:

$$r=\frac{2}{3}\sqrt{\frac{[vv]}{m-1}} \tag{23}$$

Furthermore, remembering that ε and r have reference to the precision attainable from a single observation, we can get the corresponding errors belonging to the arithmetical mean from m observations by the aid of the principle already used, viz.: that the diminution of error is proportional to the square root of the number of observations. Denoting the mean and probable errors of the arithmetical mean from m observations by ε_0 and r_0 equations (22) and (23) give:

$$\varepsilon_0=\sqrt{\frac{[vv]}{m\ (m-1)}}\,. \tag{24}$$

$$r_0=\frac{2}{3}\sqrt{\frac{[vv]}{m\ (m-1)}}\,. \tag{25}$$

Mean and Probable Error for Several Unknowns.— Equation (22), so far as we have yet considered it, applies only to the case of a single unknown x observed directly m times. But a similar expression can also be found for the case of observation equations of the form (4), when solved by means of normal equations of the form (9). Having found values of the unknowns x, y, z, from the solution of normal equations, we substitute these values in the original observation equations, and thus obtain numerical values of the residuals v, by which amounts the original observation equations fail of being exactly satisfied. With these values of the v's we compute $[vv]$. If we then let:

u = the number of unknown x, y, etc., appearing in the original observation equations, it may be shown that we shall have for the mean and probable errors:

$$\varepsilon = \sqrt{\frac{[vv]}{m-u}}. \tag{26}$$

$$r = \frac{2}{3}\sqrt{\frac{[vv]}{m-u}}. \tag{27}$$

For the complete demonstration of these equations we must refer to works on the Method of Least Squares. The equations furnish average approximate values for the mean and probable errors of any average observed quantity n, as it appears in any observation equation of the form (4). The unknowns x, y, z, are of course determined from the whole group of equations with much greater precision, and therefore with smaller mean and probable errors. In the case of z, for instance, it is shown in works on Least Squares that its mean and probable errors are smaller than those given by (26) and (27) in the proportion of:

$$\sqrt{[cc.\ 2]} \text{ to } 1,$$

where $[cc.\ 2]$ is the final coefficient of z appearing in the last reduced equation (13) resulting from the Gaussian elimination of the normal equations (9). Consequently, denoting by ε_z and r_z the mean and probable errors of z, we have:

$$\varepsilon_z = \sqrt{\frac{[vv]}{[cc.\ 2]\ (m-u)}}, \tag{28}$$

$$r_z = \frac{2}{3}\sqrt{\frac{[vv]}{[cc.\ 2]\ (m-u)}}. \tag{29}$$

The corresponding mean and probable errors of x and y can be found by rearranging the observation equations in such a way that each unknown in turn will come out last in the Gaussian elimination.

Weights.— It happens sometimes that the quantities n, appearing in the observation equations (4), have been determined by the observers with unequal precision. For instance, a certain n may have been observed twice, while all the others depend upon a single observation only. In such a case, that particular n is said to have «double weight,» or the weight 2, while all others have the weight 1 only. Obviously, we can treat this case in our reductions by simply writing the doubly weighted equation twice, with all its coefficients and unknowns, among the observation equations, and then proceeding as usual. There is, however, a better way of dealing with this matter of varying weights; and we can derive it from a consideration of the rule for the formation of normal equations from observation equations. We may use the following:

Rule for Weighting Observation Equations.— Multiply each observation equation throughout by the square root of its weight and then form normal equations by the usual rule.

It may be seen readily, in the simple case of one equation only having double weight, that this rule will produce precisely the same effect on the normal equations as would result from merely writing that particular observation equation twice among the other observation equations, in the manner just explained. But it is also shown in works on Least Squares that the above rule for weights holds good when all the observation equations have different weights, and even when these weights are fractional.

To illustrate the foregoing, we shall give the complete solution of a set of observation equations resulting from a precise determination of clock error made with the transit instrument of Columbia University Observatory in New York. The observation equations were as follows, the numerical terms n being expressed in seconds of time.

$$\begin{aligned}
x + 0.04y + 1.29z - 0^{\mathrm{s}}.27 &= 0,\\
x + 0.08y + 1.26z - 0.02 &= 0,\\
x + 1.36y + 2.84z - 6.52 &= 0,\\
x - 0.23y + 1.54z - 1.32 &= 0,\\
x + 0.03y + 1.30z + 0.06 &= 0,\\
x - 0.07y - 1.30z - 0.02 &= 0,\\
x + 0.14y - 1.21z + 0.84 &= 0,\\
x + 0.03y - 1.30z + 0.48 &= 0,\\
x - 0.01y - 1.33z + 0.31 &= 0,\\
x - 1.28y - 2.75z - 4.68 &= 0.
\end{aligned} \tag{2'}$$

Each of these equations depends on the observation of a different star; the unknown x is the clock error, and the other two unknowns y and z relate to certain errors of adjustment in the transit instrument.

The solution now proceeds as follows:

Applying the «Rule for Normal Equations» gives:

$$\begin{aligned}
+0.34x - 0.63y + 29.43z - 9^{\mathrm{s}}.78 &= 0,\\
-2.63x + 3.59y - 0.63z + 15.30 &= 0,\\
+10.00x - 2.63y + 0.34z - 11.22 &= 0.
\end{aligned} \tag{9'}$$

The method of equations (10) and (11) transforms these into the following:

$$\begin{aligned}
+2.90y - 0.54z + 12^{\mathrm{s}}.35 &= 0,\\
-0.54y + 29.42z - 9.40 &= 0.
\end{aligned} \tag{11'}$$

A further application of (12) gives:

$$+29.32z - 7^{\mathrm{s}}.10 = 0. \tag{13'}$$

From this we obtain:

$$z = +0^{\mathrm{s}}.24. \tag{14'}$$

If we now substitute this value of z in either of equations (11′) we obtain:

$$y = -4^{\mathrm{s}}.25.$$

These values of y and z can now be substituted in either of equations (9′), and we get:

$$x = -0^{\mathrm{s}}.005.$$

We now substitute the numerical values

thus obtained for x, y and z in equations (2′), and obtain the following residuals, v:

V	VV
$0^s.125$	0.015625
.055	.003025
.075	.005625
.025	.006250
.125	.015625
.005	.000025
.045	.002025
.045	.002025
.025	.000625
.125	.015625
	$[vv]$ .060850

Applying equation (27), remembering that m is the number of residuals, in this case 10, we have:

$$(27') \qquad r = \frac{2}{3}\sqrt{\frac{0^s.060850}{10-3}} = \pm\, 0^s.061.$$

This is the "probable error" of a single observation. To obtain the corresponding quantity for the value of z given by equation (14′) we must use equation (29). We have from (13′):

$$[cc.\ 2]=29.32.$$

Consequently, from (29):

$$(29') \qquad r_z = \frac{2}{3}\sqrt{\frac{0.060850}{29.32\ (10-3)}} = \pm\, 0^s.011.$$

This result signifies that it is an even chance whether the actual error of our numerical value of z is greater or less than $0^s.011$, so that the probable error becomes a sort of test of the precision of our result.

To obtain the probable error of another unknown, as x, we rearrange the equations (2′) so as to make x the last unknown, instead of z. Written in this way, the equations are:

$$(2'') \qquad +0.04y + 1.29 + x - 0^s.27 = 0,$$
$$\text{etc.,} \qquad \text{etc.}$$

The normal equations are:

$$(9'') \qquad \begin{aligned} &+3.59y - 0.63z - 2.63x + 15^s.30 = 0, \\ &-0.63y + 29.43z + 0.34x - 9.78 = 0, \\ &-2.63y + 0.34z + 10.00x - 11.22 = 0. \end{aligned}$$

The method of equations (10) and (11) gives:

$$(11'') \qquad \begin{aligned} &+29.32z - 0.12x - 7^s.10 = 0, \\ &-0.12z + 8.07x - 0.01 = 0. \end{aligned}$$

The application of (12):

$$(13'') \qquad +8.07x - 0^s.01 = 0.$$

And, consequently:

$$(14'') \qquad x = +\,0^s.00.$$

This is practically the same as the value already obtained, and thus affords incidentally a very complete check on arithmetical accuracy. Values of y and z can of course be obtained as before by substitution.

Applying equations (29) again, we have the probable error of x:

$$(29'') \qquad r_x = \frac{2}{3}\sqrt{\frac{0.060850}{8.07\ (10-3)}} = \pm\, 0^s.022.$$

Equation (14″) shows that the clock was exactly right; and (29″) that the precision of this clock-error determination is very high.

Bibliography.—Wright and Hayford, 'Adjustment of Observations'; Chauvenet, 'Spherical and Practical Astronomy' (Vol. II, Appendix); Jordan, 'Vermessungskunde' (Vol. I).

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LEATHER, Artificial. See LEATHER SUBSTITUTES.

LEATHER, Chamois. What is known in the market as chamois skin is really an oil-tanned sheep or lamb skin lining. The supply of skins from the chamois animal is very limited; enough could not be obtained in a year to supply the United States for more than a single day. In Switzerland about 5,000 to 6,000 skins would be a fair average yearly crop. This skin is heavier than the skin of the sheep or lamb, also much coarser. For strength and durability this skin is preferable, but for ordinary use and appearance the oil-tanned sheep-skin lining would, in most instances, be preferred.

To manufacture sheep or lamb skins into chamois leather the first step necessary is to remove the wool, which is accomplished either by painting the skin on the inside with a solution of sodium sulphide or by immersion in milk of lime. By the former method the wool is loosened in a few hours; by the latter method it will require several days. When the wool is loose it is pulled off either by hand or scraped off with a dull instrument. The skin is now again immersed in milk of lime, to swell it. It is then cleaned (beamed, as the trade calls it), to remove all fleshy particles that may adhere to it. It is now ready for splitting. The chamois skin is really only the half of a skin. The outside, that is, that part of the skin next to the wool, known as the grain side, is not suitable for chamois leather, and is used for other purposes, mostly for hat linings, book covers, etc. In former times, when skins were prepared for oil tannage, this part of the skin was cut away with a suitable knife and thus lost. In our days the skin is cut through the centre (split), thus producing two skins from one — the outside, called grain or skiver, and the inside, called lining or flesher. The splitting is accomplished on machines specially constructed for this purpose. It consists of an endless knife, the edge of which is constantly grinding to keep it sharp, the skin being passed through rollers against the sharp edge of the knife. These machines require very delicate adjustment to produce good results.

The lining or flesher is now ready for tanning. This is accomplished by sprinkling it with oil, codfish oil of good quality. It is important that this oil should be thoroughly incorporated into the skin. For this purpose a quantity of the skins are placed into what are known as fulling stocks, which twist and turn the skins in every direction and distribute the oil evenly. After sufficient milling the skins are partly dried and the process of sprinkling and drying is repeated again and again until they are full of oil and all the moisture is dried out. They are now allowed to hang sufficiently long to thoroughly tan them at a temperature of about 100°. The process after this is very simple. The oil is removed by pressure and the balance washed out by saponification; after this they are dried and they are then ready for finishing. The oil, by the way, is recovered, by decomposing the soap solution with an acid and separating. It is sold to manufacturers of other leathers, it being useful to make them pliable, etc. The finishing is done mostly by pressing the skin against revolving wheels, covered with emery or flint to remove all adhering substances and to present a finished surface. We now have the finished chamois leather ready for the trimming and sorting room, where it is cut into suitable sizes and packed for the market. Of late years a trimmed skin, that is, skins of even sizes, are preferred by the trade. For this reason most manufacturers, at least most American manufacturers, cut their skins over patterns so as to produce uniform sizes. In former years, when England and France supplied the United States market, the skins in the same package would vary in size and shape, thus lacking uniformity. See also HIDES AND LEATHER.

LEATHER, Manufacture and Uses of. Of all the ancient industries that of the manufacture of leather is one of the most interesting on account of the convertibility of an easily decomposed substance into one which resists putrefaction. The manufacture of leather is as old as history itself. In China the manufacture and use of leather was known before the Christian era, and in Egypt leather has been found in mausoleums of the ancients, showing us that nations in the remote ages of the past were practised in the art and left slight traces of their high civilization to be admired to-day. The Persians and Babylonians passed the art over to the Greeks and Romans and so down through the different mediæval nations to us. The American Indians were also well versed in the art of making leather, although their method of tanning was entirely different to that of the ancient races, yet the fact remains that they also discovered a way of treating the skins of animals in such a way as to prevent the putrefaction of animal tissues.

Composition of Hides and Skins.— The skin of an animal consists of three layers — the outerskin, middle and underskin. The outerskin which cannot be tanned is removed with the hair, leaving the middle skin or grain and the underskin or flesh. The upper part of the skin in which the coat of hair, wool or fur is rooted is a thin layer termed the epidermis or cuticle. Next beneath this is the much thicker corium or true skin, and next to this the under skin.

The epidermis does not combine with tannin or other substances to produce leather. It is therefore useless to the tanner and is removed at the same time as the hair. The portion of the skin thereby exposed is technically termed the «grain» side. The corium or true skin is the actual leather skin and is made up of interlaced bundles of gelatinous fibres. It is more or less filled with fluid matter that serves to renew the cuticle and maintain the skin in a pliant and moist condition. In the tanning process these matters are removed, reducing the weight of the skin considerably, and there remains nothing but the fibrous portion to be acted on by the tanning materials. The quality of leather which can be produced from a skin depends upon the thickness, flexibility and strength of the corium, which exceeds the combined thickness of all the other layers of the skin. The under skin consists of a loose connective tissue, in which the sweat and fat glands, the blood vessels and the muscular fibres are embedded. The side upon which the connective tissue of the under side is located is technically designated as the «flesh» side. The under skin or flesh is composed of interlaced fibres which give the strength to the tanned stock and is therefore a most important factor for the tanner while the middle skin gives the fine smooth appearance to the finished product. The skin, being organic, is composed of carbon, oxygen, hydrogen, nitrogen and sulphur, which go to make up the middle and under skin.

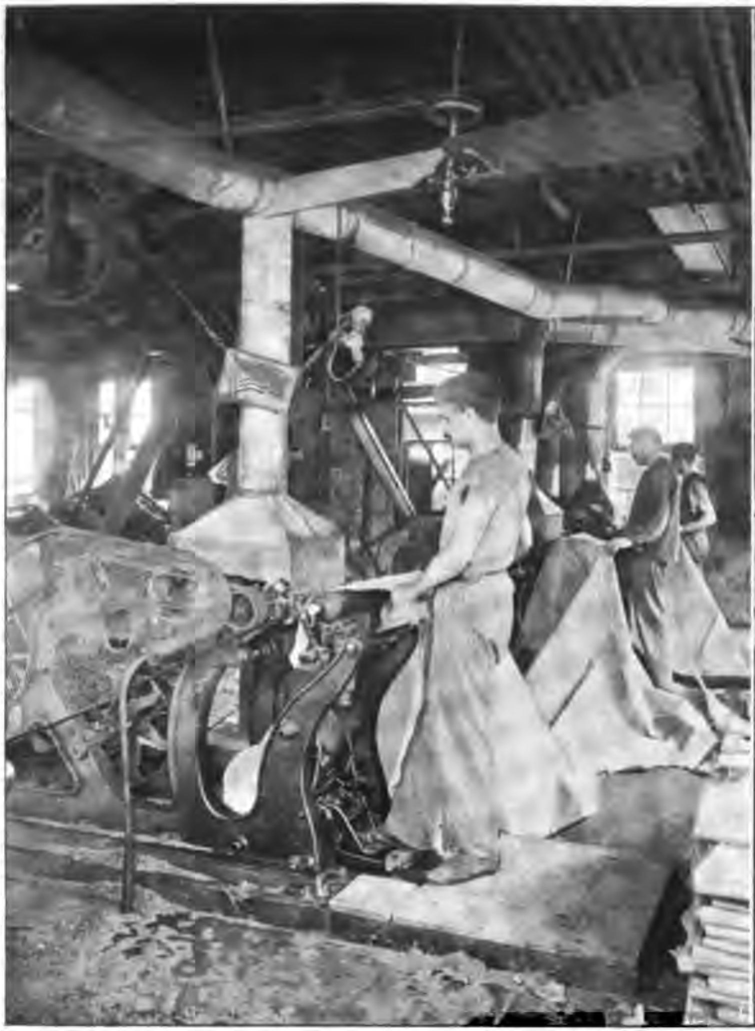
Source and Uses of Hides and Skins.— Most of the leather in common use is made from the hides and skins of domestic animals, those of cattle being by far the most important, followed by goatskins, sheepskins, horsehides, pigskins and in a small measure dogskins. Many skins of wild animals, principally those of the kangaroo, deer, peccary, alligator, seal, walrus and buffalo are in fairly general use. Cattle hides are used chiefly for shoe upper and sole leathers, harness, belting, upholstery, bag and case leathers, and to some degree in bookbinding. Goatskins are used for shoes, gloves, bookbinding and fancy leathers. Sheepskins are used for shoe linings, gloves and the greater part of the fancy leathers. Horsehides are used for shoes and utility gloves. Pigskins are used for the inner parts of shoes, utility gloves, bookbinding, fancy leathers and saddle seats. Dogskins find limited application in glove leathers. Kangaroo is used for fine shoe leathers. Deerskins, known as buckskins, are used for both shoes and gloves, peccary for utility gloves, alligator for bag and fancy leathers, seal for bags, bookbinding and fancy leathers, walrus for jewelers' polishing wheels and buffalo for heavy soles.

Preliminary Processes.— The skin, as received by the tanner, is either green, green salted, dry and dry salted, and in whatever state received, the first process is to trim the hides to remove all useless pieces and adhering fat, but the dry salted skins are first softened. When thoroughly trimmed, so as to pass inspection of the foreman, the skins are placed in the soaks. The soaks are large tanks filled with as pure cold water as can be obtained to which salt has been added in order to open the pores of the skin, and the skins are allowed to remain there for 24 to 48 hours, with periodic agitation or stirring, due care being taken not to heat the stock. The object of the soak is to soften the skin and to remove all foreign matter such as dirt, salt and blood. Great care must be used to remove all blood and salt, as these materials, if left on the skin, will cause stains which will show dark spots in the finished leather if colored into tan, and dull if made into blacks. Another object of the soak is to add water to the skin to bring it back again as near to the condition in which it was when taken off the animal. The water of the soak must be cold, not above 65° F., so as to prevent all bacterial action and thereby prevent the loss of what tanners call hide substance. The soaking is controlled by the chemist, whose duty it is to examine the water for dissolved «hide substance,» that is, to analyze the water of the soak for ammonia. As mentioned, the hide contains nitrogen. This organic nitrogen is converted either by bacteriological or chemical action into ammonia, due to over warm water or too long in the soaks or both. The skins are then taken from the soaks and placed in a revolving drum and washed thoroughly with clean cold water in order to remove all adhering foreign matter. They then go to the fleshing machine, a machine which consists of spiral blunt knives, set into a revolving cylinder, to remove all superfluous fat on the flesh side of the skin. From the fleshing machine they go to the lime vats for loosening the hair, plumping the stock and spreading the fibres apart.

Depilation.— In the more modern process of liming, the skins are treated with a mixture of lime and sodium sulphide, a chemical obtained in the manufacture of washing soda or by other processes. If it is not desired to save the hair, which is valuable, the skins may be dehaired by the use of sulphide of soda alone. Hair can also be loosened by «sweating,» that is, to hang the stock in chambers where the temperature and humidity can be controlled. This process is simply a partial putrefaction which affects the base of the hair roots, so as to allow them to be easily removed. The sweating process is used, now very seldom, in the manufacture of sole leather, and formerly to remove the wool from sheep skins. The depilation now in use is accomplished by lime or the above former mentioned combination of lime and sulphide. The lime vats are similar to the soaks. The skins are placed in a saturated solution of slacked lime, in which there is always an excess of lime, so that the calcium hydrate, which is slacked lime, is absorbed by the skin, the lime liquor remains at the same strength by the water dissolving some of the excess of lime always present. Lime is used on account of its being a weak alkali and only acts upon the softer parts of the skin, such as the hair bulbs, etc., while it hardly acts upon the harder parts of the skin; yet, by leaving the skin too long in contact with lime, the harder parts are also affected. Bacterial action of the limes must also be taken into consideration for depilating, as new limes are very slow in removing the hair, and the action of the lime is increased as it grows older. The liming takes from two to three days, and sometimes longer, according to the raw material placed in the vat and the kind of stock required. Here the chemist is called again to control the time and the action, so that the skins do not become too soft or lose too much substance, thereby making the skins flabby and loose. From the lime vat the skins are either dehaired by hand or machine. Although machine dehairing is quite satisfactory, the skins must be worked by hand in order to remove the fine hairs which were left by the machine. The skins are then placed upon the beam, a semi-circular board placed on end, similar to a barrel cut in half in length with the convex side up, with the flesh side of the skin toward the workman, who cuts off the remaining flesh, fat and tissue. From this operation the skins are washed thoroughly in clean, cold water to remove all adhering lime and as much of the dissolved lime as possible. In order to get all the absorbed lime out of the skins, they are again placed in a vat of water in which fermented hen manure, dog dung or pigeon manure is dissolved, and allowed to remain in this solution until by chemical reaction all alkali is shown to be removed. The lime is sometimes removed by chemical means in the use of lactic acid, the acid of sour milk, and in the newest processes the material used is an extract made from the various organs of the animal such as the spleen, pancreas, etc. This process is known as bating. The fermented animal excrements used produce lactic acid by bacterial action, but also has the advantage of containing bacteria which are very essential in this process of bating. The idea of bating is first to render soluble the insoluble salts of lime, which the skins take up, and then to bring the skin, which swells in the alkaline lime liquor, back to the state desired by the tanner to produce leather according to his needs. The skins are again washed and are ready for the tan, if vegetable leather is required, or for pickling in case chrome tanned stock is to be made.

Tanning Materials.— In vegetable tanned stock the skins are hung on sticks and placed in vats and treated with a dilute water extract of bark, hemlock, oak, quebracho, a South American wood, sumac, myrobalans, mimosa or Australian willow, valonia or oak acorns from Greece and Turkey, and many other materials too numerous to mention or combination of the different vegetable tannins. The liquor in the vats is strengthened daily with the extracts until the skin is thoroughly tanned or as the tanner would say «struck through.» The vegetable tannages are limited only by the number of plants, barks and other vegetable substances which yield tannins in sufficient quantities for commercial use. In practice only a few tannins offering the advantages of cheapness, large supply and greater suitability are used. Hemlock and oak bark liquors and extracts separately or in combination are used more than any other vegetable tannins. Most sole and belting leather, practically all upholstery, harness, bag, strap and case leathers and some shoe and bookbinding leathers are tanned with hemlock or oak or both. Sumac is the principal tanning material for bookbinding leathers, on account of its giving a light-colored leather that is resistant to light and decay. Gall-nuts, myrobalans, divi-divi and oakwood are also used in bookbinding leathers. Valonia and chestnut oak extract are used for sole leather in connection with oak and hemlock. Quebracho is used in various leathers, often with hemlock and oak. Gambier and palmetto are used in many of the softer leathers for shoes, gloves, etc. Some leathers are tanned with a mixture of three or four different vegetable materials as may be necessary to give the color, firmness and other properties desired. A distinct tannage of limited use is the oil tannage used for making some glove leathers, particularly chamois and buckskin. Cod oil is the oil commonly used. Its oxidation tans the leather. The leather is then washed, oiled or placed in a revolving drum with a combination of oils and greases which is called «Fat Liquoring» and hung up to dry. The skins are now ready for coloring and finishing which will be explained further on under chrome or chemical tanning.

Chrome or Chemical Tanning.— The vege-



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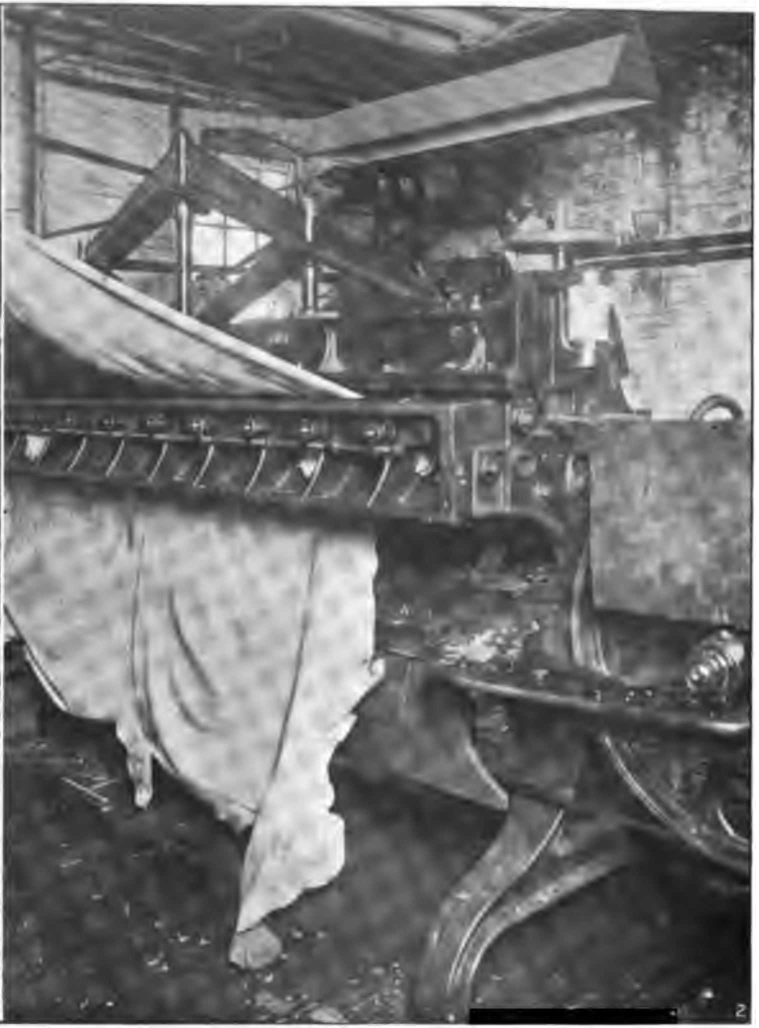

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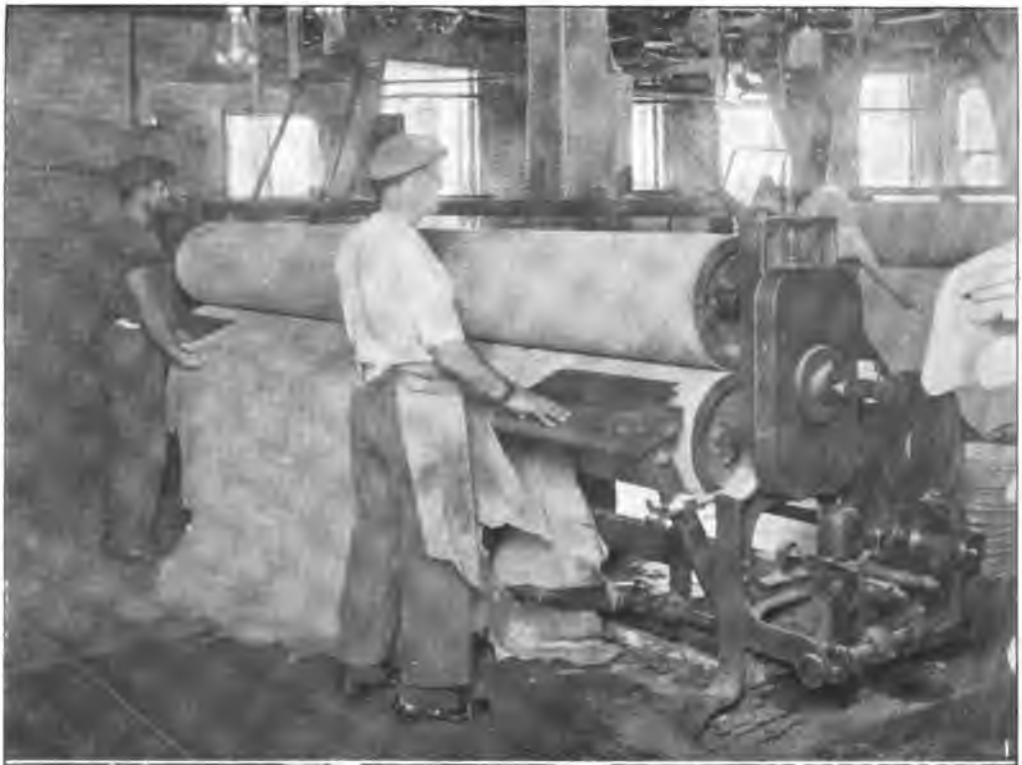
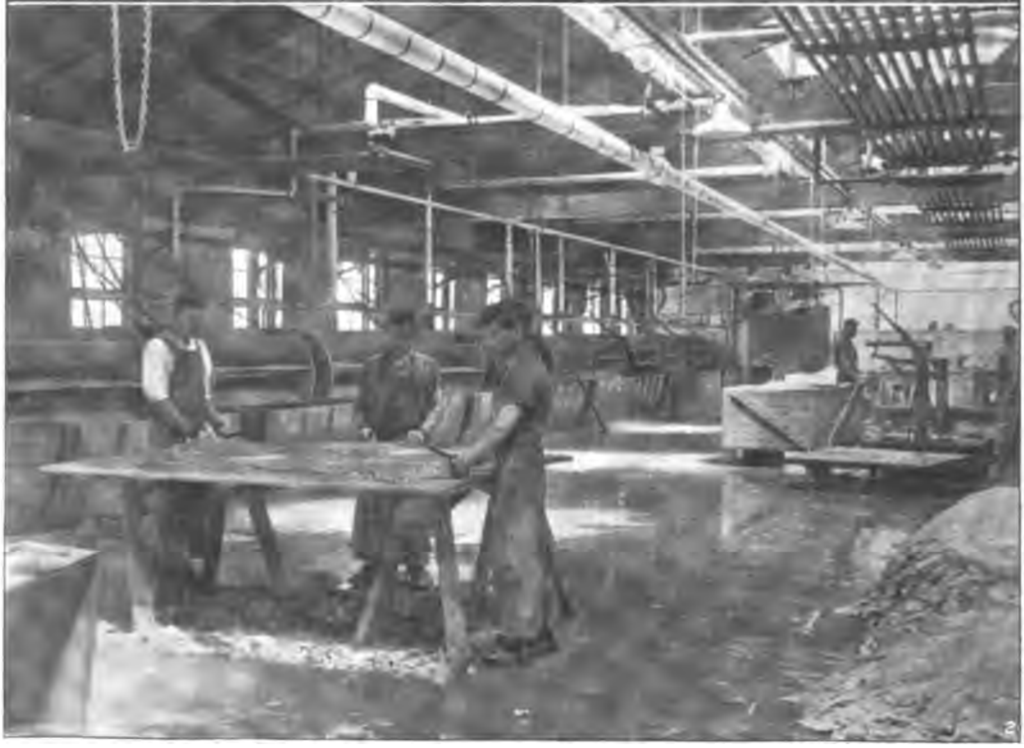
1 Shaving off the grain to make leather smooth

2 A leather splitting machine at work. This machine makes two sheets of leather out of one, without varying one five-hundredth of an inch from the thicknesses for which it is gauged

LEATHER MANUFACTURE





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1 Softening raw hides with rolling machines, in a big American tannery
2 Trimming untanned hides — sulphide, *lining*, and washing paddles at the left

table method of tanning light leathers is being replaced by chemical tanning or combination of vegetable and chrome now considered chemical or chrome tanning. In order to prepare the stock for chrome tannage, it is first pickled after being washed out of the bate; that is, placed in a vat, fitted with a revolving paddle similar to a water wheel, in which is dissolved salt and sulphuric acid mixed in different proportions, according to the ideas of the foreman. When the skins have absorbed enough of the chemicals, they are taken out of the paddle, allowed to drain and then pressed in an hydraulic press to squeeze out the water. They are then split on a machine, which consists of a fast running horizontal belt knife or drawn over a stationary knife being pressed on to the edge of the knife by a roll placed above the knife. The thickness of the skin is regulated by the distance between the belt knife or stationary knife and the roll. Light stock such as calf, kip, goat or sheep are not split but shaved on the flesh. The chemicals used in the manufacture of chrome leather are mostly imported and before we enter the realm of modern chemistry as applied to tanning it will be of interest to know where the raw materials are obtained and what they are. The raw materials are sulphuric acids, glucose, sodium thiosulphate, soda ash and chrome salts. Sulphuric acid or oil of vitriol as generally known is obtained by burning sulphur or brimstone. Glucose or grape sugar is obtained from corn starch. Sodium thiosulphate, commonly known as "Hypo," a salt with which every photographer is familiar, is also obtained from sulphur or brimstone by heating it with caustic soda, known as soda lye. As a by-product sodium sulphide is also obtained, which as already said is used in the dehairing process. Soda ash or calcined soda is obtained from salt. The chromium salts used in the tanning are made from chrome iron ore, a very hard mineral composed of the oxides of chromium and iron and mined mostly in New Caledonia, although some is mined in Canada, Turkey in Asia and California, but the quantity is so small as to be no factor in the manufacture. The chrome iron ore is mixed with lime and soda or potash, placed in a furnace with free access to the air and roasted at a high temperature. When finished, the mass is treated with water to extract the sodium or potassium chromate formed. Sulphuric acid is then added and the liquor evaporated and allowed to crystalize, and the resulting crystals are sodium or potassium bichromate, the mother substance for the manufacture of the compounds used in the tannery. This bichromate is used in the tannery, as such, for the so-called two-bath tannage or converted into its salts, to be used in the one-bath process. The one-bath and two-bath processes are chemically similar. The two-bath produces the chrome salt desired in the skin, while the one-bath process consists of forming the chrome salt desired and when so made to mill or drum it into the skin.

It is interesting to note that the first practical chemical or chrome tanning was invented in the United States by an American, August Schultz, in 1884. Since that time great advancement has been made in chrome tanning in America and Europe but the theory has remained the same, yet the fact remains that it was discovered in the United States and due to the research of an American. Schultz's patent was for a two-bath, while Professor Knapp of Germany published in 1858 a process for the one-bath process, though he did not recognize its value. In 1893, Martin Dennis, of Newark, N. J., recognized its value and was granted patents on this process. For the two-bath process, the pickled stock is taken and placed in a revolving drum with water in which common salt is dissolved, the drum closed and set in motion. Then bichromate, i.e., either sodium bichromate or potassium bichromate, is dissolved in water, a certain amount of sulphuric acid added for the purpose of changing the bichromate into another chrome salt which will be absorbed by the skin. Bichromate without the use of an acid (and sulphuric is used in preference) will not penetrate the skin, and this mixture is put gradually in the drum. When all bichromate has been added and the skins are "struck through," that is, the yellow color of the bichromate has thoroughly penetrated the skin to its fullest extent, a solution of thiosulphate of soda, "Hypo," is added. These materials, when in contact with the yellow colored stock, will turn them blue by precipitating an insoluble chrome compound between the fibres of the skin and chrome-tanned leather, is the result of this stage. A solution of soda ash or calcined soda is now added to the stock in the revolving drum to neutralize the acid present and also to convert any soluble chrome compound present to an insoluble. The stock is now thoroughly washed, pressed and sent to the machines to be split down to the required thickness and to be shaved smoothly on the flesh. The next process of tanning is probably the most important to the tanner of to-day, namely, the one-bath process. The one-bath process, in which the liquor used is blue, is the same with the exception, as above explained, the liquor is already made and simply milled into the skin. The tanner tests his stock from time to time in order to know when it is thoroughly tanned. This test is simply taking a piece of the heaviest part of the skin and boiling in water for five minutes. If the stock remains soft and does not curl after the expiration of the time, the stock is considered tanned. After tanning is finished, the stock is again washed and pressed, and is ready for the fat liquoring, coloring, drying, resoftening, tacking on boards to dry, staking and finishing. The fat-liquoring process is to mill oils, soaps and greases into the stock in order to keep them soft and pliable and at the same time render them semi-water proof. Staking is stretching the skins by machine in order to get a smooth surface. The coloring of the skins is done by the application of wood dyes or coal tar colors. The coloring of the stock is of great importance. In order to prevent the dye-stuffs from going on unevenly, great care must be exercised. Blacks are made either by the use of logwood or aniline colors.

Finishing Processes.—Those leathers which are not shined and which always have a dull appearance such as used in work shoes may be sponged with oils, measured and sorted into grades to be sold. A good many leathers are boarded in order to give them a distinctive pattern. The grain side is folded on itself and rolled under pressure with a cork surface board attached to the arm. This makes a square pattern on the surface when done up and down and from side to side of the skin. Leather for dress shoes on which a bright or semi-bright lustre is desired must be seasoned and glazed. Seasoning consists in sponging the surface of the leather with a liquid dressing consisting of albumen or some similar preparation which will coagulate with the heat of friction. After seasoning and drying leather is glazed. The glazing process brings up the polish in about the same way that a brush does on shoes. The skins are glazed or rubbed over with a glass cylinder under great pressure. This glass cylinder is placed horizontally in a pocket at the end of a long wooden arm, which is brought down over the skin by a connecting rod from the fly-wheel of the machine. The skin is laid over a slanting board and held there by the operator who shifts its position so that all parts of the skin come beneath the glazing cylinder which moves up and down in a straight line, continually bearing on the skin with a heavy pressure. Some skins on which a dull polish is wanted are brushed over the surface with a revolving roller brush. Leathers on which a high polish is desired are sponged with finish, dried and glazed several times in succession. If an especially smooth surface is desired the leather is embossed after the first glazing. This is done by placing the skin beneath the hot steel plates of a heavy hydraulic press. The last operation is sponging a light coating of oil over the skin.

Shoe upper leather is sold by the square foot and is measured by power driven measuring machines. Each skin is passed through the machine and a dial on the machine indicates the measurement to one-fourth of a square foot. Patent leather is chrome tanned, dried, fat-liquored and dyed black as previously described up to the finishing process. Some of the grease given in fat-liquoring and some of the oil applied to the grain are not combined with the fibres, and unless removed will cause the varnish to slip over the leather so that finishing becomes impossible. Degreasing is best done by soaking the leather in naphtha, and then pressing out the naphtha and drying the leather. When ready for finishing the skin is spread out and tacked on a frame, and the varnish, which is mainly oxidized linseed oil, is applied with a brush similar to a paint brush. The skins on these frames are then placed in ovens so that the varnish may be baked on. Generally several coats of varnish are baked on the skin.

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LEATHER-BACK, or **LEATHER-JACKET.** See LEATHER-TURTLE.

LEATHER-BEETLE, one of the dermestid beetles (see DERMESTES), which in the grub state damages leather in storehouses and after it is made up into articles, such as shoes, harness, etc. The species is *Dermestes vulpinus;* and it is also a pest in silk manufacture, eating the cocoons. Infested places should be thoroughly fumigated with bisulphide of carbon, or some other powerful gas.

LEATHER-FISH. See FILE-FISHES.

LEATHER-HEAD, an Australian bird, the friar-bird (q.v.).

LEATHER AND SHOE TRADE TECHNICAL TERMS. The following is a list of the more important terms used in the shoe and leather trade:

ACID TANNED.— Tanned by the use of a mineral acid, instead of the usual vegetable tanning substances, derived from the bark or wood of certain trees and plants. (See Tanning.)

ADJUSTMENT.— A general term applied to the fastening of a shoe, whether button, buckle or lace, etc., by means of which the shoe is adjusted to the foot, or more definitely used in referring to the amount of play of such fastening available in conforming the shoe to the foot. The lace is the easiest of all adjustments, as it is flexible and self-conforming. The strap and buckle has less adaptability. Buttons are adjustable by re-setting, effective machines having been devised for that purpose.

ALASKA.— An overshoe, having a cloth upper and rubber vulcanized sole, usually with high front and back.

ALOFT.— (Said of sole stitching.) A sole "stitched aloft" is stitched without a channel on the under side, the thread showing on the bottom of the shoe.

ALUM TANNED.— Subjected to a dry tannage or tawing with salt and powdered alum. (See Taw.)

ANKLE BRACE.— A steel brace built into the top of a shoe to support a weak ankle or other defect. Also may be made of sole leather, molded to conform to the shape of the foot, usually built into children's shoes for the protection of weak ankles.

ARCH.— The bony framework of the foot, extending from the heel forward to the toes, which is sustained by the muscles and ligaments in the form of an irregular arch. (There is a secondary transverse arch of the foot also at the ball, the bones being slightly arched crosswise.) This part of the foot is subject to various ailments, due principally to relaxation of the muscles, ligaments and tendons, which permit the turning of the main arch inward, the "broken arch" or "flat foot," so called, being more an eversion than anything else, although its action does flatten the foot. The term "arch" is applied also to the under portion of the shoe, curving from the heel forward toward the ball, and to the corresponding portion of a last.

ARCTIC.— A high, thick cloth and rubber overshoe fastened with one or more buckles.

BACKSTAY.— A strip of leather covering and strengthening the back seam of a shoe; "California" or "accordeon backstay," a term sometimes applied to piping, caught in the back seam of a shoe; "English backstay," or "jockey backstay," a broad backstay extending forward and meeting the quarter on each side.

BAL.— (An abbreviation of the word "Balmoral," from the original English name of the shoe.) A front-laced shoe of medium height, as distinguished from shoes that are adjusted by buttons, buckles, etc., also as distinguished in pattern from the "Blucher."

BALL.— The fleshy part of the foot back of the toes, or the corresponding part of a last or shoe. The girth here is an important point in the measurement of shoes and lasts.

BALLET SLIPPER.— A specially constructed slipper for professional women dancers, with reinforced soles and no heels, made of leather, usually light kid.

BAREFOOT SANDAL.— A name given to heelless low-cut shoes for children, having deeply slashed vamp and quarter and fastened by means of straps and buckles.

BASEBALL SHOE.— A shoe built of canvas or leather for the sport indicated, having triangular shaped plates on both ball and heel to prevent slipping. Usually made on modified gypsy or scout pattern — laced well to the toe.

BASIL.— A heavy bark tanned sheepskin, used for lining or insoles.

BATHING SHOE.— A heelless canvas shoe, usually fastened with laces or thongs about the ankle, and used at the shore in outdoor bathing.

BATH SLIPPER.— A light, loose slipper, usually heelless and often made of cloth, fibre or even paper, and used about the house or bath.

BEADED.— Having edges of upper leather skived thin and folded in, instead of being left raw. Another meaning is, trimmed with beads, as the vamps of women's slippers.

Beaver-top.— A name applied to warm cloth shoes.

Bedroom Slipper.— A soft, comfortable slipper, made of wool felt, soft cotton fabric, or soft leather, with flexible sole — either of sole leather, or light chrome stock with very low heels, or spring heels; sometimes knitted or crocheted and attached to a lamb's wool sole.

Bellows Tongue.— A broad, folding tongue, stitched at each side to the top of a Blucher shoe or boot, for the purpose of making it water-tight. Used in work shoes, also hunting boots, etc.

Belting.— The best portion of a bark-tanned cowhide, used for the making of leather belts for machinery.

Bench-made.— Applied to shoes which are made at "the bench" — i. e., the cobblers' bench. Shoes made entirely by hand are rare in these days, although some fine lines of factory shoes are claimed to be "hand-welted"; that is, to have the welt, upper and insole sewed together by hand, thus promoting flexibility.

Bend.— The best and strongest part of a side of leather.

Bicycle Bal.— A shoe originally designed for bicycle riders, but later adopted for use in other outdoor sports. It is usually laced well down towards the toe and has a protecting toe cap.

Blacking.— A general name for paste shoe dressing.

Blind Eyelet.— An eyelet which is concealed on the inner side of the lace stay, the lace hole being left raw-edged on the outer side.

Bloom.— A slight appearance of mildew or mold which sometimes appears on shoes in stock. (See Spewing.) It may be wiped off readily.

Blucher.— A shoe or mid-leg boot, named for its inventor, General Blucher of the Prussian Army of the time of the first Napoleon. A distinguishing feature of the Blucher is the extension forward of the quarters to the throat of the circular vamp, the quarter being loose at the inner edge, and made to lace across the tongue which was originally a bellows tongue. After its adoption in the Prussian Army in form somewhat similar to the present hunting or sporting boot, it became very popular. The feature of the extended quarter was later adopted in shoes of ordinary height and with the ordinary type of tongue, as well as in Oxfords, and this form of cut is still much used in all classes of shoes, men's, women's and children's. It is a curious fact that all three of the great generals engaged at the battle of Waterloo invented a form of military footwear.

Blucher Bal.— A pattern combining both the features of the Balmoral and the Blucher, having a whole quarter vamp and top, as in the Bal with an over-lapping front as in the Blucher.

Boarded.— Finished with a lined surface faintly indented or stamped into the leather.

Boot.— This term is used in England only to designate high-cut shoes for men, women or children as distinguished from slipper, pump or Oxford (which last only is called a "shoe"). It is largely, although not universally, so used in this country, although the term "shoe" is often used here to designate a high-cut; the term "boot" is sometimes restricted to the men's solid leg boot, or laced hunting boot.

Bootee.— A boot with short leg, sometimes made with rubber goring over the ankle, and sometimes made with lace front extending from the throat of the vamp over the instep to the ankle. Thus made, for men, it imitates in wearing the appearance of an ordinary boot or Bal. The term also refers to a half-leg length boot, usually knitted for infants.

Boot Jack.— A V-shaped board or frame, in which to catch the heel of a leg boot to pull it from the foot. Returning to use because of military and riding boot wearing.

Bottom Finish.— The final polishing, painting, buffing, or, other process applied to the bottom of a completed shoe. The simplest form is the plain "grain finish," in which the outer sole is left almost untouched, as in cheap shoes. The "acid finish" consists of light buffing off of the grain and treatment with an acid polish, which gives the bottom a hard, waxy surface. Different colors are produced by stains applied immediately after buffing. "Velvet Bottom," a bottom buffed, then chalked and buffed again producing a velvety nap. "Painted Bottom," a stained bottom with wax coating. Fancy designs, or trade marks and names, are sometimes stamped on bottoms. "Black bottoms," are painted with edge blacking, rubbed down and polished. Viscolized soles have a gray color of their own. Another gray sole is produced by applying blacking and then buffing.

Box Calf.— A proprietary name for calf leather finished with the grain side boarded or stamped with irregular rectangularly crossed lines.

Boxing.— A stiffening of leather or other material used in the toes of shoes to preserve their shape. This is often made of canvas stiffened with glue or similar material, sometimes of thin metal, in cheap shoes.

Bracelet Tie.— An Oxford pattern with an extended back cut from same piece of material, including at its top, ankle high, a strap around the leg — total height of shoe five or six inches.

Break.— To crack through or crack the surface finish as in patent leather. "Break of the shoe," the creasing and fine cracks which form over the ball, in wear.

Breast of Heel.— The forward face of a heel, under the shank, which is not usually finished otherwise than by trimming smooth; in French or other wooden covered heels the breast is built to extend forward sloping into the shank, and covered by leather cemented to it.

Brogan.— A heavy pegged or nailed work shoe of ankle height.

Brogue.— A name originally applied to rough, heavy shoes, originally made of untanned calfskin with the hair left on; the word is sometimes used incorrectly for "brogan."

Brogued Vamp.— A vamp overlaid with long, extension wing tip.

Bronze Kid or Calfskin.— Leather finished with a form of cochineal dye. This dye (made from the bodies of small insects), which stains cloth a vivid red, when applied to leather gives it a peculiar bronze-colored, metallic semi-iridescence. This method of finishing leather has long been known and the leather for many years has been used in women's fancy slippers, principally in kid, with an occasional period of favor as a material for street wear, such as that of a few years ago. The delicate character of the finish, and the tendency of the cochineal dye to rub off when wet, has led to the development of aniline dyes.

Buck or Buckskin.— Strictly speaking, tanned or tawed deerskin. This term is loosely used, and a great deal of so-called buckskin is suede-finished calfskin or side leather or suede kid. Buckskin is nearly always used white or in a light shade of champagne, but is used also in black. By recent common usage, the term "buck" has come to be fully understood to mean the suede-finished cowhide.

Buckram.— A stiff, strong canvas, stiffened with glue and used as a foundation for the tips of shoes or as a cemented backing for fabrics used in shoemaking, etc.

Buff.— A split side leather, coarser than "glove grain," but otherwise similar, used for medium or cheap grades of shoes, principally men's. (See Split.) As a verb, the terms mean to scour off the outer or "grain" side of leather.

Buffalo Sole.— The hide comes from the true buffalo of Asia and the East Indies. Hemlock tannage. Coarser and more porous than cowhide. Used for heavy nailed shoes.

Burnish.— To polish, as the edge of the sole.

Buskin.— A woman's low cut house shoe of either cloth or leather, having small, triangular-shaped goring on top of front at instep.

Button-fly.— The lapped over and strengthened strip of leather in the front of a button shoe in which are the buttonholes.

Cabaretta.— This trade term is applied to a leather the origin of which is often disputed. It has appearance of being either a superior sheepskin or a rather inferior goatskin. The Cabaretta is a cross between a sheep and a goat and its leather partakes of the character of both. It comes from South America chiefly. Very common in a dull or "mat" finish for tops of patent leather and other shoes.

Cack.— An infants' smallest hard-soled shoe with no heel, sizes 1 to 5.

Calfskin.— For trade convenience, skins of neat cattle of all kinds are classified as follows: Weighing up to 15 pounds, green, "calfskins"; 15 to 25 pounds, "kips"; all above 25 pounds, "hides." This is, of course, merely an arbitrary distinction for trade convenience, and the qualities of the extremes in each grade merge into those of the next grade. There is also a great deal of variation in the qualities of skins of the same weight, which is true of all kinds of skins, and is a fact which makes leather grading a difficult task, requiring long experience, and which also complicates the practical work of the shoe manufacturer. No two skins are precisely alike, and different parts of the same skin vary.

Calking Machine.— An appliance to depress or shape the inner sole of a shoe, to make it conform to the shape of the bottom of the foot.

Callous.— A spot of thickened and toughened skin on the palm of the hand or sole of the foot. The latter under continued pressure develops into a corn.

Carriage Boot.— A loosely made boot for women, usually of fabric, often fur-trimmed, and intended to be worn in winter, being slipped over the ordinary shoes or slippers. Commonly used over dancing slippers.

Carton.— The pasteboard box in which each pair of fine shoes is usually packed. The carton is a comparatively late development in the trade. The first approach was to wrap each pair in ordinary paper. Pairs were formerly kept together by a string knotted through holes in the heel, as "bargain shoes" are sometimes handled now. The National Shoe Retailers' Association, 14 Jan., 1914, endorsed standard sizes of cartons and the following measurements in inches.

	Length	Width	Depth
Men's	12 2-4	6[illegible]	4[illegible]
Misses'	10[illegible]	4[illegible]	3[illegible]
Women's	11[illegible]	5[illegible]	3[illegible]
Boys'	11[illegible]	6	3[illegible]
Youths'	10[illegible]	5[illegible]	3[illegible]
Children's	8[illegible]	4[illegible]	2[illegible]

"Stock cartons" are special cartons which are kept on the shelves permanently, instead of being used to deliver shoes to the customer. Sometimes these are made of double length, for double depth shelving.

Case.— The variable-sized box in which shoes are packed for shipment; men's usually 12 pairs in a case, women's 24 to 36 pairs, etc. Cases for foreign shipments are often much larger. (See Show Case.)

Castor.— Suede-finished kid, for gloves, usually in lighter weight than is used in the making of shoes.

Cement.— A general term applied to adhesive materials. Various kinds of cement are used in the manufacture of shoes as between the heel lifts, between soles, fastening beaded edges, etc. "Rubber cement" is a solution of India rubber which is useful in shoe repairing as well as in manufacturing.

Chamois.— The alum-tanned skin of a variety of deer. The leather is very pliable and may be washed. It is used more often for gloves than for footwear, being very soft and pliable. Much imitation chamois is on the market, this being alum-tanned sheepskin.

Channel.— A slanting cut made around the edge of a sole or insole where stitching is to be done. Such a cut is made on the outside of welt and McKay shoes, the lip of the channeling being cemented down after the stitching is done, so as to present a smooth bottom and to keep the bight of the stitch from being exposed to immediate wear. (See illustration under Welt.)

Children's Sizes.— A series of sizes running in two divisions from 5 to 8 and from 8½ to 11. Children's shoes form a larger proportion of the total than is usually realized. Tables of population show that one-third of all the inhabitants of the United States are below the ages of 15 years. (See Sizes.)

Chrome Sole.— In sole leather the full thickness of cattle hides is used. Chrome-tanned sole is the strongest and lightest sole leather. It is slippery and porous and has a rough edge. Sometimes stuffed with grease to make waterproof. Used chiefly in outing and athletic shoes.

Chrome-tanned.— Tanned with bichromate of potash and dilute muriatic acid. (See Tanning.)

Circlet.— A proprietary name given to a small horseshoe-shaped tubelet of steel, to be driven into the heels of shoes for the purpose of preventing undue wear.

Circular Vamp.— A vamp so cut as to join the quarter in a seam on each side of the shoe running down to the shank, instead of being continued straight back to the heel on one side as in a three-quarter vamp shoe, or on both sides as in a whole vamp shoe. (See Vamp.)

Clog.— A heavy soled, very low cut shoe, sometimes with wooden soles.

Cobbler's Seam.— A seam made by stitching through and through, the pieces being laid so that the edges are even instead of being lapped.

Collar.— A narrow stitched-on strip of leather, around the outside of the top of the shoe, usually for ornamental effect.

College Boot.— A boot for girls, cut lower than the "Polish," to about ankle height.

Colonial.— A low shoe made principally (although not exclusively in the past) for women's wear, having a flaring tongue outside with a large ornamental buckle across over the waist. The buckle and tongue are distinctive features, whether the shoe fastens with tie or strap. This shoe is supposed to date from Colonial days in this country, although examination of old-time prints will show that a shoe oftener worn (at least by men) had only a broad silver buckle without the flaring tongue. In the strict "Colonial" the flaring tongue extends above the instep, instead of lying flat to the foot, below the instep, as in the case of most of the "tongue pumps," which seem to be a sort of variation of the Colonial, evolved by the addition of a tongue to the pump.

Coltskin.— This term is applied to split leather made from horsehide, as well as that made from what would be strictly considered a colt. Colts are used for food in certain parts of Russia, just as veal calves are used in this country, and the hides are a staple article in Russian commerce. The leather is of firm, solid texture, and has been much used in recent years for patent leather.

Combination Last.— A last some part of which varies from the usual standard measurement; for example, being wider or narrower at the ball or heel than the regular standard. (See Last.)

Comfort Shoes.— Soft, flexible shoes with low heels, made for invalids or elderly people.

Congress Gaiter.— An ankle-high shoe with leather or cloth top, adjusted to the ankle by a gusset of rubber goring in the sides instead of by laces, buttons, etc.

Copper Toe.— A copper boxing or lip, used to protect the toe, in children's shoes.

Cordovan.— The adjective is derived from the name of the Spanish city, Cordova, which had an ancient repute for the making of fine leather, either from goatskin or horsehide, the Spaniards having been for some centuries the world's best tanners. Cordovan leather from horse butt (rear part of horsehide) tanned with gambier and other vegetable tannings. Colored in black, tan, etc., and finished on the flesh side. A very close waterproof leather because of the impermeable shell in this part of the horsehide. Used in high grade men's shoes. It is expensive and is imitated in calf and sides.

Corduroy.— A ribbed velvet-like fabric. One objection to it as a shoe material is that it is thicker than some fabrics in common use, tending to give toes and ankles a clumsy appearance.

Cothurne.— An ancient type of Roman low shoe, laced about the ankle, recently revived by French shoemakers.

Counter.— A piece of stiffening material which passes around the heel of the shoe to support the outer leather and prevent the shoes from running over. Counters are made of sole leather, split leather, pasted (thin splits and skivings) canvas backs, cemented (two thin leather pieces with leather board between) fibre board and leather board. Counters are shaved thin at the edges and shaped by machinery. In women's pumps the counter is sometimes extended forward in the inner side, almost to the ball of the foot. In heavy shoes for miners, furnace men and iron workers, metal counters are sometimes used on the outside of the shoe.

Court Tie.— A men's low, straight-topped Oxford usually in patent leather, with black silk tie, and of a type which is prescribed by court ceremonial dress requirements in England and other countries, whence the name. Also applied to women's two or three eyelet ties usually on Blucher pattern. It is often used as a dancing shoe by men who find pumps uncomfortable or lacking in adjustment.

Cowboy Boots.— A peculiar type of leg boot with high, fancy tops, with very high heels, of approximately Cuban contour. These boots were and are worn by Western cowboys, who are seldom on foot. One purpose of the high heel is to prevent the foot slipping forward in the stirrup, in riding horseback.

Cowhide.— Used to refer to cattle hides weighing from 25 pounds upward, green salted, also the leather made from such hides. (See Hides, also Calfskin.)

Creaser.— An implement for making parallel creases or straight wrinkles in the vamp of the shoe across the ball, causing the shoe to break evenly.

Creedmore.— A cheap, heavy shoe for men, Blucher cut, with bellows tongue.

Creole.— A heavy workshoe of the "Congress" type; that is, having rubber goring in the sides.

Crimp.— To shape to the front of the foot the one-piece vamp and leg of a highside-seam boot, or riding boot.

Crimped Vamp.— A vamp which runs in one piece to the ankle or higher, as in the "nullifier," or in side-seam leg boots for farm use, etc.

Cuff.— A strip of leather, wider than a "collar," sewed around the top of a shoe. Both "collar" and "cuff" are used principally for ornamental effect.

Cupped Sole.— Applied to the depressions in a sole caused by the ball of the foot in wearing. Shoes the soles of which are much "cupped" sometimes present a difficult problem in half-soling, in order to avoid changing too much the general shape to which the foot had adjusted itself.

Cushion Sole.— A padded innersole.

Custom Made.— Made by hand to the customer's special order and measurement. The term is also used to apply to factory-made shoes which are designed upon conservative models which have been in common use in custom shoemaking.

Custom Toe.— This designation was intended to refer to a toe of standard and unchangeable type, but in late years the type itself has been modified. The modern "recede" toe is of similar design.

Cut-off Vamp.— A vamp which is cut off at the tip and stitched to the tip, instead of continuing forward under the tip and being lasted in with it. It is claimed by makers of medium and cheap grade shoes that this offers an economy in leather which does not detract from the general cost-balance of the cheap shoe.

Dom Pedro.— A heavy one-buckle shoe with bellows tongue. This name was originally proprietary. The shoe was introduced at the time of the visit to this country of Emperor Dom Pedro, of Brazil, and was made in high grades. The lack of adjustment was against it, and it eventually took its place among styles of working shoes.

Dongola.— Heavy plump goatskin, tanned with a combination of vegetable and mineral acids, and having a semi-bright finish. The terms "Dongola," "kid" and "Morocco" are sometimes loosely used interchangeably. The terms "Dongola" and "Morocco" are geographical and indicate the origin of the leathers thus named. (See also Cordovan.) The name was used a number of years ago as a proprietary name applied to antelope leather.

Dress Shoes.— Shoes appropriate for use with formal attire, and for social occasions. The requirements of fashion are more exact there than in any other class of shoes, and the salesman should have dependable knowledge of what is deemed correct style. Men are perhaps in more need of guidance in this matter than are women.

Dull Calf or Kid.— Leather having a smooth but dull and unglazed finish.

Eclipse Tie.— Proprietary name of a one-eyelet tie for women, stitched close at the throat and having a small, pointed tongue.

Edge Setting.— Finishing the edges of the soles with polish, applied under heavy pressure or by rubbing.

Edge Trim.— This term refers to the method of finishing the edge of the sole. "Beveled edge," "round edge," "square edge," etc., are self-explanatory; "fudge edge," having the welt seam hidden, close to the upper; "extension edge," an extra wide edge. Fancy edge include a great variety of stamping and knurling. "Square-edged turns" are sometimes called "English welts" or "mock welts." "Feather edge," the thin edge often seen in "turned" soles.

Elkskin.— A term applied usually to soft tanned calfskin, used in sporting and outing shoes.

Embossed Leather.— Leather stamped or carved with various figures, geometrical and ornamental. A recent method of producing consists of cutting away a background, leaving the pattern in relief.

Enamel.— Leather with a shiny finish on the grain side as distinguished from "patent" leather, which is usually finished on the flesh side, or the surface of a split leather. (See Patent.)

English Last.— A term applied to a last the principal characteristics of which are an extra long recede toe and low heel.

English Welt.— A Mock Welt.

Everett.— A type of men's slipper low in the back, but coming up over the waist in front to the instep.

Extension.— The addition of a size or sizes to the standard measurement of a last, to allow for the forward curve of the toe, or the addition of a fraction of a size for each additional width above the sample width, in grading lasts. (See Last.) Also applied to extra width in edges of sole, or to the edge itself.

Eyelet.— An annular ring of metal, etc., inserted through and clinched in the lace holes of shoes; "blind eyelet," top invisible and bottom clinched; "worked eyelet," a lace hole finished with stitching like a buttonhole.

Fabrics.— A general term designating woven or knit cloths of any kind, made from animal or vegetable fibres, such as wool, silk, flax, cotton, etc. Fabrics of various kinds have been used in shoes for many years.

Fair Stitching.— Stitching applied around the sole, showing on the upper side; usually applied to a "McKay" shoe to imitate a "welt."

Fancy Slippers.— A general term applied to light slippers made for women's indoor evening dress wear, and made of silk, satin or the finer leathers, usually with French heel or Spanish heel, and variously ornamented, with beading, embroidery, plain or jeweled buckles, etc.

Faust Slipper.— A high cut house shoe similar to a "Romeo" with V-shaped cuts at the sides, instead of U-shaped and no goring.

Felt.— A sheet made of fibres of wool, hair, fur, etc., matted together and rolled flat, usually with sizing to give it consistency. It differs from a fabric, inasmuch as the fibres are not spun into threads and then cross-woven, but are merely allowed to drift into a loose layer in a current of air, then flattened into a sheet under pressure.

Filler.— A light form of wood or other material placed in a shoe used as a sample, for display or in stock, to distend it to the appearance it would have when worn. A New York store introduced a plan of placing fillers in each shoe as it was put in stock, these being sold to the customer at a cheap rate to use as shoe trees. Light, hollow wood fillers are made by last makers, following the exact conformation of the different lasts they produce and therefore filling and fitting perfectly the shoes which are made from such lasts.

Findings.— A general term applied to articles which are incidental or accessory to the manufacture, the trimming or the care of shoes. The list includes practically everything in shoes except leather. As applied to the shoe store, it includes such articles as laces, polishes and dressings, shoe trees, foot powders, rubber heels, arch supports, heel plates, shoe horns, shoe brushes, insoles, fancy buckles and numerous other incidental articles.

Finger Foxed.— Having a pieced Blucher quarter so cut that the heel foxing extends forward to the throat in a narrow strip below the upper part of the quarter, the lower piece looking a little like a hand with the fore finger extended.

Finger Stitching.— Stitching which reinforces the lapped quarter of a Blucher shoe.

Finish.— The final methods and processes of preparing the leather for use, or of polishing, buffing or otherwise treating the soles of shoes upon completion. (See Bottom Finish and Leather.)

Fitting.— The selection and adjustment of ready-made shoes, with reference to their adaptation to the foot of the intended wearer.

Full information is given under the subject Lasts as to the scale of measurements, especially with reference to the additional extensions.

Fitting Stool.— A low, slanting-topped stool upon which the shoe salesman sits when trying on a shoe, it having a ledge on which to rest the foot of the customer while adjusting the shoe thereto.

Fixture.— Any stand, bracket, hook, support or other device for displaying samples of the merchant's shoe stock, in window or other parts of the store.

Flange Heel.— A heel made with a flare toward the "top lift," or bottom of the heel as the shoe stands when worn.

Flat Foot.— A term applied to "broken arch."

Flat Last.— A last with comparatively little arch or toe spring.

Folded Edge.— An edge skived thin and cemented down in fold, as distinguished from an edge which is left as it is cut. Applied to the parts of an upper.

Foot Form.— A proprietary name for last or shoe made in close conformity to the natural outline of the foot.

Foothold.— A low rubber overshoe, having no heel, but adjusted by a light heel-strap; sometimes called "Sunny South" rubbers or "sandals."

Foot Muff.— A fur or woolen bag in which to place the foot for warmth while riding or driving.

Foot Powder.— One of various preparations, some proprietary, dusted on the foot for sanitary or strengthening purposes.

Foxing.— A piece of leather forming (or covering) the lower part of the quarter of a shoe. In earlier days, when shoe patterns were very simple, this term was loosely used as applying to the vamp also, and this use has not altogether disappeared. For example, "slipper foxed" (or "whole foxed") is a term applied to whole vamp shoes for women. "Three-quarter foxed," having a three-quarter vamp.

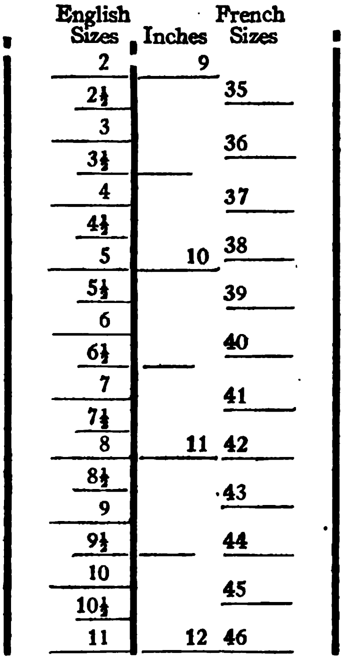
Freak Shoes.— Term most often applied to a wide, almost straight across toe, same width as at ball of foot, usually used in conjunction with term "freak last." Also shoes of style that might be classed as "insane novelties"; shoes of style marked by bizarre, startling, unusual features, outside the limits of good taste.

French Calf.— Genuine French Calf was formerly imported to this country in considerable quantity. It was a wax finished calf leather of firm quality and high grade.

French Chalk.— A soft steatitic chalk or talcum used to dust in shoes to facilitate their slipping on the foot.

French Foot.— Made with a single seam in the center of the sole; applied to hosiery.

French Sizes.— The French sizes for shoes run on a scale of measurements, as well as numbering, entirely different from those used in this country. (This refers to the explicit meaning of this term, not to what is known as "French Size Marking," which see.) The size is about one-fourth of an inch.



French and English Sizes actual measurement in inches

French Size Marking.— This term applies to a system (which probably did not originate in France) of marking American or English size and widths. It is applied, in fact, to a variety of systems, the principal feature being that it is a cipher or secret method, which does not reveal to the customer the actual size of the shoe. A great variety are in use — too many, in fact, as it makes trouble for the manufacturer. In marking the widths, instead of using the ordinary lettering, arbitrary numbers are used. For example, if you put down the number 10 to indicate AA widths, then 11 would represent A, 12 would represent B, etc. Your key sheet for widths would stand thus: —

Widths..................	AA	A	B	C	D	E	EE
Your width markings.....	10	11	12	13	14	15	16

In marking the sizes, start in the same way with some arbitrary number. For example, use 20 for size 1, 20- for sizes 1½, etc. Your key to size marks would stand thus:

Sizes...........	1	1½	2	2½	3	3½	4	4½	etc.
Your marks.....	20	20-	21	21-	22	22-	23	23-	etc.

In using such a system, the width number would be set down first, with the size number following. For example, the mark for a 4B shoe would be simply the figures 1223. The "12," as shown above, would stand for B width and "23" for 4 in size.

Stock being once marked in this way, all that would be necessary for the sales force would be to keep in mind the key and translate backward. For example, a shoe is marked 1521-; the "5" of the 15 indicates the fifth letter of the alphabet or E, which gives the width; add one to the "1," which gives you size 2, the dash indicating the half size; the shoe is therefore a No. 2½, E width. The second and fourth figures are the principal ones. This is only an example of many such keys. The principal purpose of all such markings is to avoid all controversy with customers over sizes. Many strong firms, however, have discarded them and have educated their customers to depend upon the store's expert knowledge of fitting, without regard to the marked size. (See Size.)

Fudge Edge.— An edge stitched very close to the upper and trimmed close.

Full Double Sole.— Having two thicknesses of outsole through to the heel.

Full Serge.— A fabric shoe made with a one-piece upper laced to the toe.

Full Vamp.— A vamp that extends forward full size and is lasted under, instead of being cut off and sewed to the tip, on the under side.

Gaiter.— A separate ankle covering, or "over-gaiter." An over-covering for the foot, of cloth, adjusted with buttons and attached with a buckle and strap, or a band beneath the shank of the shoe. "Gaiter boot," one designed in imitation of a boot with over-gaiter. Gaiter — a term also applied to a Congress shoe. (See Spat.)

Glazed Kid.— The principal form in which tanned goatskin (kid) is finished for use as shoe leather, either black or tan colored. The skins are tanned usually by the chromic acid process (see Tanning), from which they come out almost white. Blacking (or other color) is then brushed on thickly, and the skins are put through a machine which practically pounds the coloring matter into the texture of the skin, at the same time smoothing and polishing it.

Glazed kid lends itself to dyeing in a great variety of delicate and beautiful colors for ladies' shoes. The white are tanned with alum in addition as alum is necessary to give a white leather. Goatskins for glazed kid are imported from all over the world.

Glove Grain.— A light, soft-finished "split" leather, generally used for women's or children's shoes. (See Split.)

Glucose.— A variety of sugar chemically produced from starch. Certain grades of it have been used in tanning sole leather, in connection with extracts, and an abuse developed in leaving too much of it in the leather, thus adding to the weight by the introduction of a cheap material, which added nothing to the strength or value of the leather, but was charged for by the pound at leather prices.

Goatskin.— See Kid.

Golf Disks.— Small rubber inserts placed in the bottom of golf shoes to prevent slipping.

Golf Hose.— Heavy woolen stockings in fancy colors and plaids used in golf and other outdoor sports.

Golf Shoe.— Calf or cloth shoe, with or without hob nails, usually with ball straps — a specialty for outdoor sports and golf.

Goring.— A strong knit fabric in which strands of India rubber are used, rendering it elastic to a large degree. This material is used in "Congress" shoes, also in other patterns. Congress shoes are often used by railroad track men, as the foot may be instantly pulled out in case of catching fast in frogs or tracks, with cars or engines approaching.

Grain.— The outer side of a hide or skin, as distinguished from the "flesh" side. The term is also applied to leather made from or finished on the grain side of the skin. (See Leather.)

Gun Metal.— A proprietary name for a fine grade, well finished calfskin leather, chrome tanned with dull or semi-bright surface.

Gussett.— A side piece or insert of rubber webbing in the side of a Congress shoe. Sometimes applied to a full Blucher or bellows tongue.

Gypsy Seam.— A seam running from the throat straight down the front of a shoe to the toe, making a "split vamp."

Half Double Sole.— An outsole composed of one full sole to heel, with a slip sole above it.

Half Sole.— A tap sole; an extra outsole extending only to the shank of the shoe; to apply such a sole in repairing a partly worn shoe.

Harness Leather.— Leather similar to belting, and made from hides of cattle, bark-tanned and oil finished.

Heel.— The principal varieties of heels are named for their style or shape. The height of the heel is a leading consideration, and is usually expressed in eighths of an inch. "Cuban," a high, rather straight heel, without the curve of the "French" or "Louis XV" heel, which usually measures an inch and a half or more in height, and is pitched well forward under the foot with a graceful curved outline; the French heel is most often made of wood, covered with leather, with a thickness of sole leather or "top lift" at the bottom, sometimes made entirely of sole leather; "military" heel, a heel straighter than the "Cuban" and not so high; "Spanish" heel, a covered "Cuban" heel; "common sense" heel, a low heel — which may or may not indicate real common sense in the wearer or fitter. The foregoing are all used in women's shoes. The "military" heel is often used in men's shoes. In children's shoes, the "spring" heel is a low heel formed by extending the outsole of the shoe back to the heel with a "slip" inserted between outsole and heel seat; "wedge" heel, one somewhat similar to a "spring" heel, but with a wedge-shaped "lift" nailed on the outside, instead of a "slip" on the inside of the outsole. In the use of fabrics for women's shoes, heels are often covered with the same material that the upper is made from. "Anatomic" heel, a heel made principally in men's shoes, with the inner side extended forward to the extent of a half or three-quarters of an inch, the idea being to better support the arch of the foot. Aluminum heels are being experimented with, these being made of sheets of aluminum, lacquered black to correspond with patent leather. "Breast" of the heel, the forward face of it. The height of a heel is measured vertically, at the side, just back of the breast, and is taken "overall." That is, measuring from the top lift to the upper edge of the sole "Pitch" of a heel, its inclination forward under the foot.

Heel Brace.— A metal brace or frame attached to the outside of a shoe to keep the heel straight.

Heel Pad.— A pad of felt, leather, etc., placed in the heel of the shoe inside, and covering the insole at the point where the heel of the foot rests.

Heel Plate.— A plate of metal attached to the bottom of heels to resist wear.

Heel Seat.— The rounded top of the heel of a shoe, including the "rand."

Heel-stay.— A pasted lining of rough surfaced leather, such as suede, placed in the heels of Oxfords or other low-cut, shoes, to prevent the shoe slipping at the heel.

Hemlock Sole.— Tanned with hemlock bark liquor. A firmer leather than oak or union. Used for medium price men's shoes and work shoes, chiefly nailed work. Used also by repairers, especially for heel top lifts. Cheaper than oak or union. See also Tanning.

Hides.— In its trade significance, this term is distinguished in meaning from the word "skins," which applies to the skin of goats, calves, sheep and other small animals, the term "hides" referring only to those skins which are above 25 pounds in weight, from cattle, horses, etc.; "packer hides," those taken off in the large slaughter houses, which usually bring higher prices because greater care is used in taking them off.

Hip Boots.— Extra high rubber boots used in fishing or other outside work.

Hobnail.— A heavy, large headed nail, used in the soles of shoes to resist wear, or a shoe thus made.

Horn.— The "shoe horn," used especially to facilitate slipping on low-cut shoes, was originally made from a thin strip of cow's horn, scraped smooth.

Horn Fibre.— A proprietary name for a strong, resilient, waterproof composition used in making counters.

Hunting Boot.— A laced boot, usually made with "bellows tongue" and Blucher-cut, with waterproof sole, and used for hunting and other rough outdoor use.

Inlay.— A contrasting piece of leather inserted under an opening in a shoe top and stitched fast thereto, for ornamental effect.

Inseam.— The seam which in a welt shoe fastens together the welt, the upper and the insole. (See Welt.)

Insole.— The inner sole of a "welt" or "McKay" sewed shoe, to which the "upper" is stitched and the "outsole" is either stitched, nailed or pegged. This is an important part of the shoe, and requires good material.

Iron.— A measure indicating the thickness of soles. It is one forty-eighth of an inch; a "twelve iron" sole is therefore one fourth of an inch thick, etc.

Ironing Out.— A finishing process for tops of shoes, by placing the shoes on trees and using a smooth, curved usually electric-heated iron.

Jack Boot.— A heavy, all-leather fishing boot with crimped front.

Jockey Boot.— A high, straight top boot for children, usually with cuff or collar of different leather, and a tassel.

Juliet.— A negligee or house slipper for women, loose fitting and with high front and back, having rubber goring at the sides.

Kangaroo.— A fine, tough, close-fibered leather, made from imported kangaroo skins. "Kangaroo calf," calfskin finished in imitation of genuine kangaroo.

Kangaroo Sides.— Cowhide tanned with hemlock and other vegetable tannings. Part of the grain has been "buffed" off or removed by hand with a special sharp blade. Hand boarded. Used for work shoes.

Kid.— Shoe leather made from the skins of mature goats. The skin of the young goat or "kid" is made into the thin, flexible leather used in the making of kid gloves, being too delicate for use in shoes. The goats from which come the supply of kid leather are either wild goats or allied species partially domesticated, and are found in the hill regions of India, the mountains of Europe, portions of South America, etc.

Kid is rightly regarded as the shoe material par excellence for women's and children's wear, as well as for light wear in men's shoes.

Kip.— A bovine hide or skin, weighing from 15 to 25 pounds (see Calfskin), or the leather made from such a skin.

Knurl.— To decorate by use of a wheel or tool, as the edge of soles, etc.

Knurled Bottom.— Having the bottom of the sole finished with ornamental wheeling or tooling, running round the edge and parallel with it.

Lace.— Laces are made of leather or fabrics, and of various lengths, according to the use intended. The standard lengths run by quarter yards, although there are some popular intermediate lengths, such as thirty-inch, forty-inch, etc. Some ribbon laces, especially for women's or children's shoes, are sometimes furnished in continuous rolls or bolts, to be cut off by the dealer in desired lengths.

Lace Hook.— A metal hook used principally in men's and children's boots, above the instep, as a convenience in lacing, taking the place of eyelets.

Lace Stay.— A strip of leather applied up the front of a lace shoe to strengthen and reinforce the eyelets or eyelet holes.

Lapstone.— An iron plate which the cobbler holds in his lap and upon which he beats soles in order to give them a rounded shape or to solidify them, or on which he pounds down seams or folded edges with his flat-faced hammer.

Larrigan.— A knee-high leg moccasin, or boot made with moccasin sole, sometimes having a wedge-heeled sole on the outside, and used by lumbermen in the snow of our northern forests and Canada, where the name originated. The moccasin foot is the distinguishing feature.

Last.— The wooden or metal form or mold over which a leather or rubber shoe is constructed and which gives the shoe its shape. Lasts are turned to very exact measurements and proportions by the use of machinery. In the process of manufacturing welt shoes the insole is lightly tacked to the bottom of the last, then the upper is placed over the top of the last, pulled down firmly and tacked, the tacks being driven only part way in, the counter and toe boxing first being placed. This operation of pulling over and tacking is now usually done by ingenious machinery. Then follow the various processes of "welt inseaming," "beating out," etc., which prepare the shoe for the applying of the outsole, prior to which all the loosely driven tacks are carefully pulled out.

Lasts are made from seasoned maple wood, are graded in an exact scale of standard sizes, each size, half size and width requiring its proper scale of measurements. The standard scale of last measurements for ball, waist and instep, as adopted in this country, is as shown in the subjoined table.

Lasting Tacks.— Tacks which are used in the lasting of shoes. As the upper is pulled over the insole, tacks are driven about half-way in to hold the upper in place until it sets and molds itself to the shape of the last. These tacks are to be taken out before the out-sole is put on.

Leather.— An outer animal integument, tanned, tawed or otherwise chemically preserved, shrunk and toughened. Any skin or hide of beast, bird, fish or reptile may be made into leather. (See Tanning and special article on Leather.)

Leather Board.— An imitation sole leather made from scraps of leather pasted and pressed together into sheets.

Ledge.— A shelf projecting out about a foot from the rest of the shelving, some three and a half feet from the floor, and used as a convenient place to lay a shoe or carton while selecting shoes for a customer. Some modern stores have discarded this feature.

Leg Boot.— As distinguished from what is termed a "shoe" in America, a boot which extends some distance above the ankle without lacing.

Legging.— A strapped or laced covering for the leg, extending from the ankle to the knee. A "Puttee" legging is formed from a spirally wrapped strip of cloth.

Levant.— A general term indicating certain processes of tanning.

Lift.— One of the separate pieces of sole leather used in making a leather heel. "Top lift," the last piece applied in making the shoe.

Linings.— Are cut and fitted with the top of the shoe and are made from drilling or other fabric, sheepskin, calf or kid. Leather lined shoes are by many considered too warm for indoor use. The lining is sometimes found to be a weak point in shoes, and, as with other portions of the shoes, good quality is necessary in order to withstand wear.

Louis Heel.— The French heel; a covered wooden heel which pitches well forward under the foot with a gracefully curved outline, usually built with a leather top lift.

Low-cut.— The principal varieties of low-cut shoes are slipper, pump, tie, Oxford, sandal and Colonial. The pump is essentially a slipper, there being no fastening. Other varieties of slipper are mules, opera slippers, house slippers, Everetts, etc. Oxfords may be adjusted with lace or button, and may be Blucher cut or straight lace, etc. Shoes with three eyelets and upward are usually classed as "Oxfords"; two eyelets, as "sailor ties"; one eyelet, as "court ties," "Eclipse ties," etc., the latter a proprietary name for a style of low-cut shoes. In these, as with all other forms of footwear, varieties once quite distinct have been merged into each other by modern shoe designers.

Lumbermen's Overs.— A combination piece of footwear consisting of a felt boot over which is worn a heavy rubber Arctic; used by lumbermen and farmers in winter.

Mat.— Dull finished, with an unglazed surface.

Mat Kid.— A thin calfskin used for shoe uppers, having a dull mat surface and used principally in contrast with bright-finished calfskin, or with patent leather.

McKay Sewed (or simply "McKay"). — A method of shoemaking named for the inventor. The upper is lasted over an innersole, the last is then removed, and the outsole is sewed on by a thread which goes straight through from the outside, catching the upper and innersole, with the seam showing on the inside. The outsole, is usually channeled as with a welt sole, and pasted back over the seam. A sock lining is put in the shoe to cover the inside seam.

Comparison with the welt method will show that this is a simpler plan, but it has the disadvantage of being less easy to repair. The McKay machine was one of the first sole-stitching machines used. Its introduction cheapened

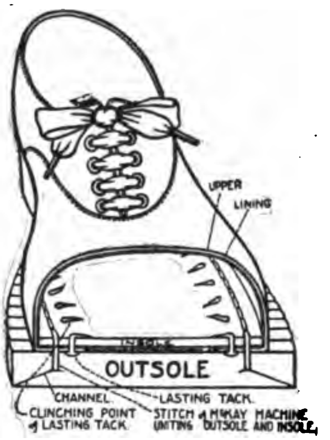
AMERICAN STANDARD LAST MEASUREMENTS.

	Sizes	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11
A	Ball	6½	6⅝	6¾	6⅞	7	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9
	Waist	6⅜	6½	6⅝	6¾	6⅞	7	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞
	Instep	7	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½
B	Ball	6¾	6⅞	7	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼
	Waist	6⅝	6¾	6⅞	7	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛
	Instep	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾
C	Ball	7	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½
	Waist	6⅞	7	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜
	Instep	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞	10
D	Ball	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾
	Waist	7⅛	7¼	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝
	Instep	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞	10	10⅛	10¼
E	Ball	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞	10
	Waist	7⅜	7½	7⅝	7¾	7⅞	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞
	Instep	8	8⅛	8¼	8⅜	8½	8⅝	8¾	8⅞	9	9⅛	9¼	9⅜	9½	9⅝	9¾	9⅞	10	10⅛	10¼	10⅜	10½

Graded in Women's and Men's Sizes.

It will be noted that no meaurements are given regarding the toes of lasts. It has been said that "all the fitting is done back of the ball of the foot; you can do what you please with the toe of a last." It is true that a great many modifications of toe shapes are made, while retaining the standard measurements of the other parts of the last.

the making of medium-priced shoes and it is still used to a considerable extent. The welt process has been much improved and facilitated within the past few years, somewhat to the disadvantage of McKays. (See Turn, also Welt.)


UPPER
LINING
OUTSOLE
CHANNEL
LASTING TACK
CLINCHING POINT of LASTING TACK
STITCH of McKAY MACHINE UNITING OUTSOLE AND INSOLE

Cross Section of a McKay Sewed Shoe.

Measurement.— The measuring of the foot for special custom orders is an art which requires practical experience. Fine custom shoemaking is almost a negligible quantity in this country, except in large cities. A considerably greater proportion of custom-made shoes is to be found in both France and England. The principal points of measurements are the ball, waist, instep, ankle, and total length. Size sticks are constructed which give these details. (See illustration under Last.) In some cases special single-pair shoes can be secured from the factory which will meet the needs of a difficult customer.

Mining Shoes.— Heavy, hobnailed, oil-grain working shoes for miners.

Moccasin.— A heelless shoe made with a single piece of soft leather turned up at the edges as the sole, this being stitched directly to a low upper with a saddle seam. In some there is no upper, the sole being drawn over the foot with thongs. A recent innovation is the use of a low wedge heel in connection with the moccasin sole. This shoe was invented by the North American Indians, the name being from the Algonquin language. It is the characteristic Indian shoe. Modified forms, with tops ankle high, or higher, are used in the snows of winter by Northern lumbermen. The "shoe pack" and "larrigan" are modifications.

Mock Welt.— A name applied to a square-edged, close trimmed turned sole.

Molded Counter.— A counter made from composition leather board, etc.

Morocco.— Originally a sumac-tanned goatskin leather, made in Morocco and stained red. It is still made there and elsewhere by that process, and used in book binding. This was the original significance of the term, but it is now applied to leather made in imitation of morocco, also applied in general to heavy goatskin of any vegetable tannage used for shoes, as well as to goatskin tanned by the chrome process.

Mouquet Slipper.— A cheap slipper made of webbing or other coarse fabric, for house or rough use.

Mule.— A slipper for women's house use having a high heel but no counter or quarter. They are of French origin, and are usually made of satin, fine kid, etc., and ornamented with rosettes and the like.

Napoleon Boot.— A leg boot designed by Napoleon, originally used for soldiers, having a high wave top. The Napoleon top was quite common in women's boots a few years ago.

Napoleon Tap Sole.— An extra sole so beveled in from the edge as to be invisible from above. This is sometimes used for crippled feet in connection with a built-up heel the purpose being to sustain a crippled or shortened leg in such a manner as to reveal as little as possible the existence of a physical defect.

Neat Leather.— A term applied to bark-tanned cowhide, oil finished.

Neat's Foot Oil.— A light oil obtained from hoofs and bones of cattle and highly esteemed as a leather dressing, especially for the side leathers. It is very commonly used by farmers in winter as a dressing for boots.

Nippers.— Long-necked pliers, used to cut nails or pegs, lasting tacks, etc., from the inside of shoes.

Nubuck.— A proprietary name for a white or cream colored buck leather.

Nullifier.— A shoe with high vamp and quarter, dropping low at the side and having a "U"-shaped rubber goring inserted. These are made loose fitting and are generally used for house wear.

Oak Sole.— Tanned with liquor or extract of oak bark. This is the best bark-tanned sole leather. Used for men's fine shoes and more used by repairers than any other sole leather. Can be sewed or nailed.

Oak Tanned.— Tanned with oak bark, the most common of vegetable tannings. This kind of tannage requires much more time than the newer methods which use mineral astringents, but the leather produced is superior for most purposes.

Oil Grain.— A heavy, bark-tanned side leather, finished in oil, with pebbled surface on the grain side of the skin. A split is taken off the flesh side in order to reduce the leather to a thickness suitable for use in shoes. It was originally made, and is used still, for men's heavy working shoes.

Ooze Calf.— A proprietary name given to velvet or suede-finished calfskin. The name has been one of those which became almost too popular, inasmuch as it is commonly appropriated and applied to everybody's velvet finished calfskin. As ordinarily used in the trade, the terms "ooze" and "suede" have much the same meaning. Some processes produce a leather in which the grain is buffed off and the velvet finish put on the grain side. Suede strictly is a velvet or nap finish of the flesh side of the skin, the grain being left on the other side, and thereby adding to the strength of the leather.

Opera Slipper.— The term is applied to any dress slipper for women and to a particular cut of house slipper for men. The former use is the more common. An opera slipper usually has a French heel, may have a whole or circular vamp, and is usually made of satin or other fine fabric, or of high-grade kid, calfskin or patent leather, often ornamented with beading, embroidery, etc.

Orthopedic.— This term signifies "of correct foot form." It is used as a proprietary name for shoes which make a special point of conforming to the natural outlines of the foot.

Outsole.— The outer or bottom sole of the shoe. So far as the public is concerned, it is usually "the" sole, as they know but little of interior construction.

Over-gaiter.— A cloth anklet extending down over the shoe to the vamp, usually buttoned at the side and fastened with a strap extending under the shank of the shoe. Its original use was with pumps or other evening dress shoes for winter wear. It has been at times used by men for day dress, especially abroad.

Oxford.— A low-cut shoe, coming to the instep or lower, either lace, strap or button. It may be of Blucher or straight lace cut, and may have any form of vamp, etc., as well as fancy inlays, saddle welting, collars and other ornamentation. It is made in men's, women's and children's sizes. The term is usually applied to lace shoes which have three or more eyelets, the "one-eyelet tie" and "two-eyelet tie" being so distinguished.

It is said that the shoe was first used in Oxford, Eng., more than three hundred years ago, in straight lace. The Blucher cut and the use of buttons were much later developments. This form of shoe is one of the most popular and extensively used of all patterns for summer wear. It is low enough for a reasonable degree of coolness and at the same time is high enough to have a complete adjustment to the foot. Other lower forms become at times very popular for women, but the Oxford has never been wholly displaced at any time within recent years. "Plugged Oxford," one with whole vamp and a separate lace stay.

Pack.— A name given to a lumberman's shoe, made moccasin fashion, but with the upper extending to the ankle or above.

Packer Hides.— Hides of cattle taken off in the large slaughter houses of cities. They bring a slightly higher price because of the greater care and skill exercised in taking them off. Hides taken off by country butchers or by farmers are often nicked up by the skinning knives, and any cut in the hide damages the leather produced.

Pancake.— An artificial imitation leather, made from leather scraps which are skived thin and cemented together under heavy pressure. This material is often used in heels, with a sole leather top lift.

Pasted Counter.— A counter made of more than one piece of leather cemented together. Sometimes a center of leather board or hard cardboard is used with a thin layer of leather on each side. These are, of course, inferior to solid sole leather counters, and are used only in cheaper and medium grades of shoes.

Patent Leather.— (Patent kid, patent calf, etc.). Leather finished with japan or varnish. Any firm, dry-tanned leather can be used as the basis of this well-known finish, such as kid, calfskin, coltskin, side leather, etc. After tanning and drying, the leather is shaved to uniform thickness, and successive coats of black varnish are applied to the flesh side, the first coats being dried and rubbed down so as to work the varnish thoroughly into the fibre of the leather and also furnish a smooth coating for the last application. The last coat is applied with a brush, and the leather is allowed to dry in direct sunlight. The direct rays of the sun have a chemical effect, the nature of which is not wholly understood, but which seems to be necessary for the producing of a firm, glossy coat. Various vegetable gums and oils are used in the making of the varnish.

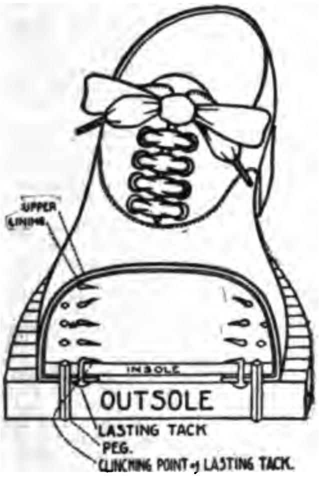
Patten.— A wooden sole shoe or clog, used in Oriental countries, elevated upon wooden supports at each end.

Patterns.— Metal or cardboard sheets from the outlines of which are cut the various pieces of the upper of a shoe, or the upper itself, as modified by differences in these outlines and shapes.

Pebbled Goat.— Tanned goatskin, finished on the grain side with a pebbled surface produced by passing it between rollers under pressure.

Peg Cutter.— An implement for planing down and smoothing the inside of a wooden-pegged shoe or boot. This was formerly a leading item of equipment in all shoe stores.

Pegged Boot.— A boot the sole of which is attached by means of wooden pegs. This method was largely used some years ago in the production of leg boots for men, as well as heavy cheap shoes for men, women and children. The perfection of sewing machinery by the McKay, welt and turn processes practically eliminated the peg, except in specialties.



Cross Section of a Pegged Shoe.

Perforation.— The principal use of perforation is for ornamental purposes in the upper of a shoe, usually along the line of seams, but occasionally extending wholly or partly across the quarter. It is usually done by means of dies, and within a few years much variation in pattern has been made. Recently, perforations for ventilation have been used, with good results.

Pieced Counter.— A counter formed of two or more pieces of leather pasted or cemented together.

Pipe.— To pull loose from the surface, forming a hollow underneath, or to ripple up the surface; applied to the loosening of the surface of patent leather, which sometimes occurs. When the varnish coat pulls loose, it usually cracks through soon afterward. The same effect is produced sometimes without actually pulling loose from the leather.

Pipe Clay.— A clay of steatitic talc used for polishing leather or for cleaning white leather. Material of this kind has come into general use in connection with white shoes.

Piping.— A thin, narrow fold of leather or other material, caught with a seam between larger pieces, or at the edge of an upper.

Pitch.— Inclination from the vertical; applied to the set of heels, more rarely to the inclination of the top of boots.

Plow Boots.— A men's solid leg boot, with top of eight inches or higher, made with side seams.

Plugged Oxford.— An Oxford cut with whole vamp, with a separate piece inserted in front and forming the lace stay and forward part of the quarter.

Polish.— The making of shoe polishes has greatly extended within the present generation. The old-style shoes made of leather with the split side out required heavy, black pastes to coat the rough surface of split leather. For this purpose many pastes containing lampblack, molasses, vitriol, etc., were sold. With the introduction of chrome-tanned dry leathers, with the smooth or hair side out, an entire change of formula was necessary.

Pastes and liquids are in varying demand as the influence of habit, the enterprise of manufacturers or convenience may dominate. The pastes are easily applied, not liable to the accidents that affect liquids and are much in favor as a safe and convenient form of polish. The liquids have the advantage of restoring faded colors, covering the dust in the seams and giving an appearance of newness that pastes cannot equal. A combination of a liquid for cleansing, restoring the color, etc., and a paste for a burnished wax finish is superior to either alone and is in steady demand wherever fine shoes are worn.

Polish (i. e., "derived from Poland").— A term applied to women's or misses' front lace boots of the ordinary height of five or more inches, measuring from the heel seat to the top. This pattern of boot is said to have originated in Poland. At any rate, it received that name very early in its progress of perfection, and the name has been generally used ever since, here as well as abroad. It is distinguished from the bal as being of more than ankle height and from the Blucher in having the quarters meet at the throat of the vamp, instead of being stayed at either side and left loose at the inner points.

Prick-Stitched.— Having the stitches which attach the sole to the welt separately pinked out and indented on the upper side.

Prince Albert.— A men's house slipper made somewhat like a Nullifier, except that it has a low quarter and is cut with a split vamp, the seam running down the front.

Prunella.— A peculiarly woven serge cloth, formerly much used for shoe topping.

Pull Strap.— A small strap of tape or leather at the top of a men's bal or leg boot, used in pulling it on the foot.

Pumice Stone.— A vitreous volcanic froth, sharply abrasive, used to produce nap on suede and similar leather, or to clean them.

Pump.— The lowest cut of all ordinary shoes, originally and usually consisting of simply a whole vamp, sole and heel. It was originally designed for a dancing shoe, and made principally for men. Within recent years it has come into very general use for women, in a form which is practically the same in cut as an opera slipper, except that the modern pump for women is used for street wear as well as house wear and is made in white as well as turns, and that it has a Cuban heel. Beginning in about 1906, its use for this purpose became very prominent.

Pump Sole.— A light single sole usually with beveled edge, used in men's or women's shoes. The term was originally applied to light turn soles, but later has come to be applied to McKays.

Puttee.— A legging used by soldiers, riders, sportsmen, etc., which is wound spirally around the leg, from the ankle up to the knee. Of later years all leg coverings detached from the shoe have been termed "puttees."

Quarter.— The back portion of the upper of a shoe, covering the heel and attached to the vamp. Quarters may be whole or pieced, may be finished with collar or cuff at top, and may have a foxing of the same or different leather. In a lace shoe, a lace stay is added for additional strength; in a button shoe, the inner and outer quarters are cut differently to allow for the lap over of the button-fly, which usually attaches by a seam down the front, although the inner quarter is sometimes run clear over without a seam. "Quartered over," having the quarter stitched on outside of the vamp. This is seen in the so-called "gaiter boots" for women.

Rand.— A piece of leather curved in the shape of a horseshoe and fitting around the top of the heel. The inner edges are shaved thin and this hollowing helps to form a rounded heel seat.

Raw Eyelets.— Eyelets which are merely holes through the lace stay, without the ordinary annular metal ring. Strictly speaking, "raw eyelets" are not eyelets at all. (See Blind Eyelets.)

Recede.— Used as an adjective in the shoe trade, this term applies to toes of shoes or lasts which are drawn down sharply towards the toe, so that the top of the toe "recedes," and is comparatively narrow and pointed rather than blunt in outline.

Reserve.— Shoes which duplicate those on the shelves stored conveniently and drawn upon from day to day, as the "forward stock" (goods on the shelves) is sold.

Retanned Sides.— A side leather in combination of chrome and vegetable tannages to give it strength, softness and resistance to barnyard acids. Boarded and brush colored on the grain. Stuffed with greases. For use in heavy work and farm shoes.

River-driving Shoes.— Shoes for lumbermen, with sharp spiked soles, used in those lumber regions where rafting is a common method of getting out logs. All lumbermen's boots are spiked; and river-driving spikes are extra long and extra sharp.

Rolling Ladder.— A ladder fastened upon rollers with floor track and upper frame, used to get at stock in stores where high shelving is used.

Roman Sandal.— A shoe or boot for women or children with the front composed entirely of straps from the throat of the vamp to the top, each strap and space being about equal in width.

Romeo.— A man's slipper often of felt with high-backed quarter and high front and slashed low at the side.

Rope Stitched.— Having a heavy corded stitching, as in the edges of soles or elsewhere, chiefly for ornamental effect.

Rubber Cement.— A quick-drying solution of rubber which forms a very useful and powerful cement often used in the manufacture of leather shoes.

Rubber Heels.— These are made for use in either men's or women's shoes, being supplied to stores and attached there.

Rubber Shoes.— There is a considerable variety of pattern in rubber footwear, from the low "footholds" to the fisherman's hip length boot. The most common use is as an overshoe or boot, to be worn over either leather or felt footwear.

Besides regular and ordinary low cut rubber overshoes, there are a number of varieties, among which are the following: "Storm slipper" or "Romeo," with extra high front and heel; "Alaska," a cloth top rubber storm cut; "self-acting overs," so cut as to slip on without the use of the hand and with a rubber projection at the heel by which each shoe can be pushed off by using the other foot; "clog," an extra low cut rubber; "footholds," or "Sunny South" rubbers, rubbers for women which cover the forepart of the shoe only with a strap extending from the shank up over the heel; "Arctic," a heavy cloth-topped, ankle-high rubber over, fastened with one or more buckles; "snow excluders," extra high rubbers of the Arctic type; "lumberman's overs," extra heavy, buckled overshoes, intended for use over felt boots.

Among rubber boots, besides the regular height, there is the half-high boot, the leather soled boot, the thigh boot and the hip boot, the latter being the longest and coming up over the hip with a strap to attach it to the belt, and used for fishing, hunting, etc.

"Felt combinations" are rubber overshoes of the Arctic type in combination with felt boots. Tennis and gymnasium shoes are also made with rubber soles, usually with cloth or canvas tops.

Running Shoes.— Low, soft leather shoes with spiked soles used in foot racing.

Russet.— Means "tan color," and nothing else, although it is often used when the word "Russia" is intended. Bark-tanned leather comes out a yellowish brown; that is the origin of the word "tan" as applied to shade; and the word "russet" was orignally used to refer to leather which was not blackened or otherwise colored, but was left in its natural tan color.

Russia.— A calfskin leather finished by a process which originated in Russia whence the name was taken. Birch oil or tar forms a component part of the dressing which gives the leather a peculiar fragrance. It was originally bark-tanned, although the name is now applied also to chrome-tanned calfskin. The Russian "Russia" was usually dyed a deep red, and in this color is still often used for the binding of fine books. The grades which are made for use in shoe manufacturing are heavier and less expensively finished. They are usually finished in tan or brown, although black Russia has been more used of late years.

Russian Boot.— A peculiar cut of high button boot with patent leather top or cuff, also a tassel in front, popular in recent years for children.

Sabot.— A wooden shoe carved in one piece from a block of bass-wood or other light wood. It is quite common in Western Continental Europe, especially in Germany, France, Belgium and Holland.

Saddle Seam.— A seam made by stitching through and through, the pieces being laid so that the edges are even, instead of being lapped.

Saddle Welting.— A strip of leather stitched across the front of a shoe running from the shank around over the throat of the vamp to the other side.

Sailor Tie.— A name commonly applied to a two eyelet, low-cut shoe, tied with ribbon lace.

Sandal.— Originally an ancient piece of footwear which consisted of simply a sole of leather fastened to the foot by thongs or straps. As used now, it refers either to women's or children's button and strap shoe or boot, or to a low-cut shoe for children, which is made with vamp deeply slashed and perforated for ventilation. (See Roman Sandal.)

Satin.— A silk fabric of peculiar weave and glossy finish, much used in women's slippers. It is sometimes made with cotton backing. This material, like most other fabrics, requires to be backed by a strong canvas-like fabric to which it is cemented.

Satin Calf.— A grain-leather split, dressed with oil and smooth finished. It is made from the skin of a mature animal, not of a calf.

Scoot Shop.— A shop whose policy is to get out production under simplest construction — once common in New England where small gangs of men raced to finish shoes quickly.

Scotch Edge.— A wide extension edge, either welt or imitation. "Scotch outside" and "Scotch inside" are terms which indicate wide extension on one side only, with closer trim on the other side.

Screw Fastened.— Having the sole attached to the upper with screw nails, as in heavy work shoes.

Scuffer.— A light slipper; "Skuffer," a proprietary name for a specialty shoe.

Seal Grain.— A split leather which has an artificial grain stamped upon it by passing it through steel rollers under pressure. The strict application of the term is to side leather made to imitate the natural grain of a tanned sealskin.

Serge.— A twilled woolen cloth of firm texture occasionally used for shoe topping. Special weaves are always required to supply the needed firmness and elasticity.

Shank.— A strip of metal used to stiffen the sole of a shoe between the heel and the ball. The name also applies to that part of the sole of the shoe.

Sheepskin.— Sheepskin is used largely for shoe linings. The skins of most varieties of domestic sheep are not strong enough to use for the outer part of the shoe. There are varieties, however, including some Asiatics, which make fairly tough leather which is sometimes used for the cheaper grades of women's or children's shoes. It is inferior to kid in firmness of texture, and tends to scuff and tear.

Shoe.— Generally speaking, a garment for the human foot having a somewhat stiff sole and a top of lighter material, usually leather, though many other materials are used. It differs from the boots as that term is ordinarily used in this country, in not extending very far above the ankle and in being provided with some form of fastening, such as lace, button, strap and button, strap and buckle, or goring. It is distinguished from the slipper as well as from the boot. As used in America, it includes the Oxford. The English use of the term differs, in that it applies to Oxfords or low cuts, while those varieties of high shoes known as Blucher, Bal, Polish, etc., are there referred to as "boots." This use of the term "boot" is becoming more common in America.

Shoe Horn.— A curved metal device to aid in slipping the heel of the foot past the counter in putting on a shoe.

Show Case.— A glass-fronted or glass-enclosed case or box for the display of shoes or other goods.

Shrewsbury Calf.— A proprietary name for a fine quality of oil-finished upper leather.

Side.— One-half of a tanned cowhide of any tannage or finish, the hide being cut down the back.

Side Laced Boot.— A boot laced down over the ankle on either the inner or outer side, instead of in front. This is not esteemed as a very practical method of making shoes, but is usually to be found among novelty boots for women's wear. One form of the side-laced boot which is of practical usefulness is a specialty boot for extra-stout women, laced on the inner side.

Side Leather.— Cowhide, split to thickness adapting it for use for uppers of shoes or for other purposes. There is a great variety of finish possible, and considerable variety in quality. The usual method of finishing tanned cowhides includes cutting the hide in two down the back making two "sides" of it. The trade refers to "a side of sole leather," meaning half a cowhide finished whole, for soles or other use; the term "side leather" refers to the cowhides as split, and includes the leathers more specially referred to as the various kinds of "grains" and "splits." Among these varieties are so-called "satin calf," "seal grain," "box calf," "buff," "glove grain," etc. (See Split.)

Size.— The length measure of a last or shoe, taken on a certain standard width and varying slightly as the shoe is made wider or narrower. The American and English series of size vary ⅓ of an inch. That is, size 8 is ⅓ of an inch longer than size 7, etc. The series of numbers begin with the smallest infants' shoe, size 0, and run up to 13½ then back to 1 and up to 12, men's size.

In tabular form the sizes on shoes run as follows:

	Sizes	Inches	
INFANTS' 0 to 5	0	4⅓	
	1	4⅔	
	2	4	
	3	5⅓	
	4	5⅔	
CHILDREN'S 5 to 8	5	5	
	6	6	
	7	6⅓	
	8	6⅔	
CHILDREN'S (2d run) 8½ to 11	9	7	
	10	7⅓	LITTLE GENTS' 10 to 13½
	11	7⅔	
YOUTHS' AND MISSES' 11½ to 2½	12	8	
	13	8⅓	
	1	8⅔	
BOYS', 2½ to 5½	2	9	WOMEN'S 2 to 8
	3	9⅓	
	4	9⅔	
	5	10	
MEN'S, 6 to 12	6	10⅓	
	7	10⅔	
	8	11	
	9	11⅓	
	10	11⅔	
	11	12	
	12	12⅓	

Size-stick.— A rule for foot measurement having a fixed upright standard at one end and a sliding standard, the foot of which marks the sizes which are indicated on the face of the rule. In use, the customer's foot is placed flat on the stick and the sliding standard slid forward to adjust. Ordinarily from 2 to 3 sizes above the stick measurement is allowed as being the proper size of shoe to fit the foot.

Skins.— The leather trade use of this term applies to the skins of small animals, such as goats, sheep, calves, etc., as distinguished from the term "hides," this referring only to those skins from cattle, horses, etc., which are above 25 pounds in weight, green salted.

Skivers.— A term applied to thin slip soles placed in the bottom of a shoe as fillers. The word "skive" as used in the manufacturing trade means to shave or pare thin, as for example, the edges of upper leather where it is the intention to fold them under before stitching.

Slide.— A shoe ornament which may be described as "a buckle minus the tongue." This class of ornament has been in very common use for a number of years in women's shoes for street wear although it was always used to some extent in fancy slippers.

Slip Sole or Slip Tap.— A half sole running from toe to shank, between the regular outsole and the welt or insole. The term "slip sole" is applied also to a thin insole, which is slipped into the shoe either to add warmth or to adjust it in fitting it to the customer's foot.

Slipper.— This term applies generally to any footwear other than rubbers, which has no method of fastening, being merely slipped on the foot and remaining there by tension of its upper part. General varieties include bath slippers, the Everett, the Faust, the Juliet, the Romeo, nullifiers, opera slippers, all varieties of pumps, etc. The term applies also to strapped footwear for women or children, as "one-strap slipper", or "two-strap slipper," etc.

Slipper-foxed.— Made with whole vamp.

Smoked Elk Sides.— A soft chrome tanned cow or steer hide for work or athletic shoes. Very strong and tough and stays soft. Hung in a smoke-house to give it a color, imitating the Indian tannage. Called "Elk" because supposed to resemble Elkskin in appearance. Made in black and colors.

Sneakers.— Rubber-soled canvas shoes used for outing, tennis, etc.

Snuff.— To take a very thin shaving from the grain side of side leather.

Snuffed Chrome Kip.— Kips are coarser skins than veals, due to an older or poorer fed animal (grass fed). The grain if scratched or defective is snuffed off by holding grain side against an abrasive wheel. Sponged over with black dye and finished dull. Makes a durable shoe leather. Snuffed calf and sides are also common.

Sock Lining.— The strip of smooth leather cemented inside McKay sewed shoes, the purpose being to cover the stitches, which in a McKay come directly through both outsole and insole.

Soft Sole.— Infants' shoes made moccasin fashion with soles of soft kid.

Soft Toe.— A toe made without stiffening or boxing; sometimes called the globe toe. This is used in comfort shoes as well as in regular lines on men's and women's kid shoes for tender feet.

Sole Leather.— Heavy leather, dry finished, for soles of shoes. It is tanned and finished with a view to producing firm, solid texture rather than extremely pliability. Hides of cattle are used, horsehides being usually too thin. Sole leathers made from green hides are best.

Soles.— The bottom pieces of any variety of footwear. When the word is used without qualification, "outsole" is usually meant.

Southern Tie.— A two eyelet ribbon tie.

Spanish Heel.— A covered wooden heel, shaped like the Cuban.

Sparable.— A heavy, chilled iron nail, spike-shaped, with a rough head, commonly used around the heels of heavy work shoes.

Spats.— Short for "Spatterdashes," an English term for cloth gaiters, buttoned or buckled around the ankle and fastened under the instep.

Spewing.— A term applied to the formation of a substance on the surface of leather, which is called bloom and which resembles mold or mildew. It is supposed to be caused by the exuding of some of the materials used in tanning or finishing of leather, and it does no damage to the shoes in the process of becoming thoroughly seasoned while in stock. It is readily wiped off.

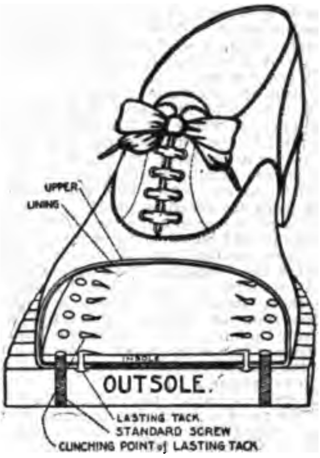
Spliced Heel.— A heel of double thickness; applied to hosiery.

Split.— To shave leather into two or more thicknesses or the leather itself thus treated. This is done to reduce heavy leather to a thickness suitable for use in the uppers of shoes, upholstery, etc. The work necessitates the use of the splitting machine.

Sporting Shoes.— Shoes made for use in various games, hunting, etc.

Spring.— The amount of variation from a straight or horizontal line at the toe of a shoe or in the arch. The "toe-spring" of a shoe may be measured by setting it on a flat surface and measuring from the surface to the under side of the sole at the toe. Shoes with but little toe spring are said to have "a flat forepart."

Standard Screwed Shoes.— In making this type of shoe the tacks used in lasting are driven way in and clinched against the steel bottom of tne last. The heavy outsole is tacked in place and fastened by means of screws. The metal which forms this fastening is in the form of wire with continuous screw thread. The machine, immediately the screw reaches the inside of the shoe, automatically cuts it off and feeds it to the next fastening. It makes a strong but stiff shoe.



Cross Section of a Standard Screwed Shoe.

Staple.— A general term applied to shoes embodying such features of style and make-up as render them subject to repeated demand from customers, as distinguished from the "novelty," the "freak," or the "specialty" (which see); shoe which with minor variations in style or ornamentation may be expected to sell in future seasons.

Stitched Down.— A simple form of shoe in which the upper is turned outward on the sole and stitched straight through. It was often used by soldiers in the Civil War.

Stogie.— A heavy-pegged work shoe of the brogan type. It may be Blucher or straight lace.

Storm Boot.— An extra high cut shoe, for women, coming well above the ankle, made of heavy leather and intended to meet bad weather conditions.

Storm Rubber.— A rubber overshoe having an extra high front and back.

Straight Last.— A last with comparatively little swing and of simple outlines.

Street Shoes.— Boots or low-cuts of solid construction, suitable for street use, especially in women's wear, as distinguished from more delicate varieties of boot, or from most slippers.

Style.— The material, cut, or model, or combination of all, which is deemed to be in accord with favored standards, or in fashion.

Suede.— A method of finishing leather; or the leather itself. The word is French for "Swedish;" the velvet finish is supposed to have originated in Sweden, and it was applied originally to kid and not to calfskin. The process of making it involves buffing (which is a process of scouring or grinding) on an emery wheel the flesh side of the leather, so as to produce a sort of nap or velvety surface. Some makers of leather adopt a different process, buffing or scouring off the grain side of the leather to produce the nap.

Suede Calf.— Skin of a very young calf finished on the flesh side by holding this side against an abrasive wheel to raise a fine nap. Worn flesh side out for ladies' shoes. Sheepskin is also treated this way. Calf makes the best suede leather for fineness and durability.

Swing.— The curvature of the outer edge of the sole of a shoe.

Tan.— A yellowish brown color, the name of which indicates the origin. The color of unfinished oak-tanned leather is a tawny, yellowish brown or "tan color," which is shortened into simply "tan" in ordinary use.

Tanning.— Converting skins or hides into leather by an astringent acid derived either from vegetable sources, such as the bark of the oak, hemlock, willow, chestnut, sumac, etc., or with a-astringent mineral substances, of which Alum may be taken as a characteristic type. In general, any acid which has what would be called a "puckery" effect will act upon a skin to convert it into leather. It toughens the skin, condenses it and coagulates all the albuminous matter so that it is no longer putrescible. That is to say, it preserves it from rotting.

It is only within comparatively recent years that mineral tannages have been in use. German chemists were the beginners, but the finishing development of chrome tannage took place in this country, and Robert Foerderer, late of Philadelphia, was well known as the originator of a successful process as applied to kid skins. His chosen trade name, "Vici," has become almost a generic name for all chrome-tanned kid, although the name was simply his own proprietary trade mark.

Tap.— A partial sole; a half sole. Sometimes applied to the lifts of a heel.

Taw.— To convert into leather by a species of dry tannage, such as packing of skins in dry salt and powdered alum. This is used when it is desired to tan skins without removing the fur, hair, or wool for use as furs or floor mats.

Tennis Shoe.— A sporting shoe, usually with canvas upper, rubber sole and low heel.

Thong.— A strip or cord made of leather or rawhide.

Throat.— As applied to the vamp of a shoe, the central part of the opening, where the top joins it in front. The term is applied to the corresponding part of lasts.

Tie.— A name for a low laced Oxford, with not over three eyelets. They are usually classified according to the number of eyelets, as one eyelet ties, two eyelet ties, etc., and ribbon laces are generally used.

Tip.— An extra piece covering the toe of the shoe, separate from the vamp, and lasted under with it; "stock tip," a tip of the same material as the vamp; "patent tip,' a patent leather tip; "wing tip," one having a point in the center and extending in curved lines backward at either side of the shoe; "straight tip," one stitched straight across in distinction from the wing tip; "shield tip," a tip resembling the wing tip but not extending so far back; "diamond tip," one ending in a sharp point at the back toward the throat of the vamp; "imitation tip," stitching across a plain vamp to imitate a tip.

Tongue.— A strip of leather the end of which is attached inside the throat of a laced shoe, coming up to the top of the shoe under the lacing. "Bellows tongue," a broad folding tongue stitched to the quarter at each side.

Tongue Pad.— A small pad fitted to the inner side of the tongue or button fly, to fit a shoe to a foot having an extra low instep.

Top.— A general term applied to all parts of the upper of a shoe usually referring principally to the parts above the vamp.

Top Facing.— A binding or lining which is sewed around the inner part of the upper of a shoe at the top. Leather, silk and other materials are used, and the name of the maker or dealer is often stamped, woven or printed thereon.

Top Lift.— The outer piece of leather in a heel.

Tread.— The floor surface of the sole of a shoe.

Tree.— A last-shaped block or filler, usually adjustable, and placed in shoes to preserve their shape. They have come into general use by wearers of shoes.

Turned Shoe.— A woman's shoe having the upper stitched directly to the sole wrong side out, the shoe being then "turned" right side out, the process giving it the name. This method is applied only to the making of light dress boots or slippers, with thin, flexible soles.

Two-piece Counter.— A counter made of two pieces of leather pasted or cemented together. The same method is sometimes used in insoles.

Union Sole.— Tanned with a combination of hemlock and oak bark liquors or extracts. Not quite as firm as oak sole. Used for women's shoes and the better grades for men's shoes. Sews well. Varies in color according to proportions of oak and hemlock used.

Upper.— A term applied collectively to the upper parts of a shoe, including vamp, quarter, lace stay or button fly, top facing, back stay, collar, etc., as stitched together and assembled.

Vamp.— The lower part of the upper of a shoe, which is stitched or otherwise attached to the sole.

Velours.— A French word meaning velvet. It is used as a proprietary name for a soft finished calfskin, chrome tanned.

Velvet.— A fabric of silk consisting of a woven backing with a fine, closely clipped pile or nap. Cheaper varieties are made with foundation of cotton or linen. As used in the making of shoes velvet is backed with a firm, thin cloth or buckram, which is cemented to it, to add to its strength.

Velvet Finished.— Finished with a nap, as suede leather, produced by grinding or buffing.

Velveteen.— A cotton velvet, or one mixed silk and cotton.

Ventilated Shoe.— A shoe with cut spaces or perforations for ventilation. The barefoot sandal is a type, as used in children's shoes. Various patented devices are also used. One of the simplest forms consists of concealed perforations in the vamp near the shank of the shoe, others continuing through the perforations in a perforated tip. The popular increase of hygienic tendencies will eventually make some such method essential in the building of summer shoes.

Vesting.— A fine silk-figured cloth, originally intended, as indicated by the name, for the making of fancy vests. When used for the making of shoes it is backed with a cemented layer of buckram to strengthen it.

Vici.— A proprietary trade name for a brand of chrome-tanned glazed kid. The name has come to be generally but incorrectly used for all makes of chrome kid.

Vienna Cut.— As applied to a shoe upper, seamless except for a half circular seam down the outside of the foot.

Viscolize.— To render waterproof, as sole leather, by the use of emulsified oils or glycerine. Viscolized soles are frequently used in hunting or sporting boots.

Waist.— The smallest part of that portion of the foot which lies between the instep and the ball, or the corresponding part of a last. In the standard scale of last measurements, the waist girth is five-eighths of an inch smaller than the instep and one-eighth of an inch smaller than the ball. See Last.

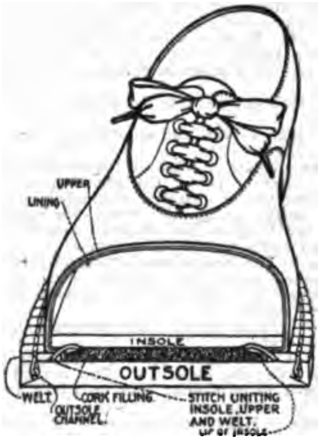
Walking Boot.— Any substantially built boot, for outdoor dress use.

Wave Top.— A double curved cut of shoe top, highest in front.

Wax Calf.— A heavy calfskin leather with a wax finish. This is among the earliest and best methods of finishing calfskin leather.

Wellington Boot.— A high leg boot, originally designed by the Duke of Wellington for use by his cavalry soldiers. The high front comes to the knee, or above.

Welt.— A narrow strip of leather stitched to a shoe; a strip of leather stitched across the upper; as most definitely and commonly used, the strip of leather which in welt shoes is stitched fast to both the upper of the shoe and the insole at one operation, called inseaming, the edge of the strip then being stitched through and through, fastening to the outsole, the seam running around the outer edge of the sole, concealed on the under side by a channel or lip, which is cut in the sole and cemented down after finishing the shoe. The term "welt" applies also to the shoe thus made. It is considered the best method of making shoes, except where extreme lightness is desired, when the single "turned" sole is used. The welt method is used in men's, women's and children's medium to high-grade shoes, and is the old hand-work method. The process of making the welt shoe involves a number of incidental machines, but the principal ones are the inseamer and the outseamer. The machines principally used are those of the "Goodyear" patent, and the term "Goodyear welt" applies to the product. "Hand welt," a welt shoe stitched by hand. "Mock welt," a square-edged turn.



Cross Section of a Goodyear Welt Shoe.

Wheeling.— A finish applied to the edge of a shoe by means of a corrugated wheel; sometimes used on a McKay to imitate stitching.

Width.— This term as applied to shoes means more strictly "girth." (See Last, for table of width measurements in inches for each size.) The variations in measurements are given in fractions of an inch, as measured with a tape-line laid round the foot or last.

Willow Calf.— A proprietary name for a grained calfskin. (Willow bark is sometimes used in tanning.)

Wooden-pegged.— Having the sole attached by wooden pegs extending through the outsole, upper and insole, as in coarse boots and work shoes.

Work Shoes.— Coarse, heavy shoes, especially those for men, as the brogan, Creedmore, Creole, Dom Pedro, etc.

LEATHER SUBSTITUTES. Owing to the increasing demand for leather in the manufacture of shoes, belting and harness, the supply of thin sections of hides suitable for upholstery, bookbinding, travel goods, etc., has steadily decreased and its cost increased. The result has been the introduction of various leather substitutes. These are of two chief classes: (1) those which imitate the appearance of leather, and (2) those which also duplicate its general characteristics and durability. In the first class there are embossed papers, papier mache, oilcloth and light weight cloths thinly coated with rubber, linseed oil compounds and soluble cotton. In the second class there are strong, thick fabrics heavily coated and embossed with rubber or linseed oil, or soluble cotton compounds. The latter successfully duplicate the coloring, feeling and embossed graining of the best hide leather. While none has at this writing been made quite the equal of real grain leather, the best grades of leather substitutes are generally more durable than what is known in the trade as «split leather,» which is composed of the weaker fleshy portions of the thick hide, split away from the grain or hair side to produce thin upholstery leather.

Split leather, coated with soluble cotton, and embossed in various grains, is really a variety of leather substitute, its base of tanned fleshy substance being about half as strong as the better grades of leather substitutes having heavy fabric bases. Split leather, commonly sold as «genuine leather,» is the chief cause of disappointments in leather upholstery as it does not compare in wearing qualities with grain leather. The fabric substitutes most used are coated with a jelly consisting chiefly of soluble cotton in solution which carries the pigment required to produce the desired color. The jelly in a fluid condition is spread on the cloth while the latter is moving over rollers. It is scraped to a thin coating by a knife set in the machine. Each coating is quite thin, successive coatings being applied to build up the desired body. The solvent evaporates during the coating process, leaving the jelly in the form of a tough, flexible film of pyroxylin firmly anchored to the cloth. The plain coated cloth is then embossed by hot rolls or plates bearing the desired grain, which is the last stage of the process. Two-color effects such as Spanish or Moorish finish are obtained as in the real leather process by flooding the grained surface with a darker coating and wiping it off in spots to give a shaded or toned effect and to show a darker color in the «valleys» than on the «hills.» Leather substitutes are now extensively used for upholstering automobiles, furniture, carriages, etc., and in various industries formerly dependent on leather.

LEATHER-TURTLE, or **TRUNKBACK,** a rare marine turtle of the tropical seas (*Sphargis coriacea*), which has a leathery case instead of a shell. It is the largest of existing *Chelonia,* known specimens having a case four feet in length, and a live-weight of not less than 1,000 pounds. When young its case is thin, soft and flexible, but as age advances the jacket becomes stiffened by the formation within it of great numbers of little adjoining bony plates and the exterior shows strong longitudinal ridges. These turtles are powerful swimmers and wander throughout the oceans, feeding upon jellyfishes, crustaceans, cuttlefishes and other animal food. Late in the summer it seeks some sandy shore or islet, where the female buries her eggs after the manner of other sea-turtles. These eggs are good to eat, but the flesh of the animal is not of good taste, and is said to be unwholesome. Much interesting discourse upon the curious structure, relationships and ancestry of this declining race may be found in Gadow's 'Amphibia and Reptiles' (London 1901).

LEATHERJACKET, common name for the trigger-fish of the family *balistidæ.* They include the *Balistes carolinensis* of warm Atlantic waters, including the Mediterranean, the *Monacanthus* of Australian waters and the *Oligolites saurus.* They are used as food in certain sections but are detested by fishermen as clever bait stealers.

LEATHERSTOCKING TALES, a name given a series of Indian and pioneer romances by James Fenimore Cooper (q.v.). The name Leatherstocking was given to Natty Bumppo, one of Cooper's heroes.

LEATHERWOOD. See CYRILLA.

LEATHES, lēthz, **Stanley,** English clergyman and Oriental scholar: b. Ellesborough, Buckingham, 21 March 1830; d. May 1900. He was graduated at Jesus College, Cambridge, in 1852 and was ordained in 1857. He was appointed professor of Hebrew at King's College, London, in 1863, and in 1868–80 he was lecturer there. He was one of the Old Testament Revision Committee in 1870–85. He was elected prebendary at Saint Paul's Cathedral in 1876, was rector of Cliff-at-Hoo, near Gravesend, in 1880–89 and at Much Hadham, Hertfordshire, from 1889 until his death. He received an honorary D.D. from Edinburgh in 1878, and Cambridge made him an honorary Fellow in 1885. In 1873 he was a delegate to the Evangelical Alliance in New York. Besides publishing many sermons and lectures he was author of 'A Short Practical Hebrew Grammar' (1869); 'Studies in Genesis' (1880); 'The Foundations of Morality' (1882).

LEAVE AND LICENSE, in English law the defense to an action in trespass, maintaining that the consent of the plaintiff had been given to the trespass complained of, thereby rendering the action void.

LEAVEN, lĕv'ĕn, a substance producing fermentation, especially in the making of bread, consisting of a portion reserved from dough already in a state of fermentation and used to cause fermentation in freshly mixed dough, resulting in a light, porous bread. The use of leaven is of great antiquity and has given rise to many figurative meanings of the term. Leaven is largely supplanted by its more convenient relative, yeast, in modern bread making.

LEAVENWORTH, lĕv'ĕn-wĕrth, **Elias Warner,** American lawyer: b. Canaan, N. Y., 1803; d. Syracuse, N. Y., 1887. He was graduated at Yale in 1824; studied law with William Cullen Bryant at Great Barrington, Mass., and in the Law School at Litchfield, Conn.; was admitted to the bar in 1827, and began practice the same year at Syracuse, N. Y. He was twice mayor of Syracuse 1849, 1859; secretary of state of New York, 1854–55; president Board of Quarantine Commissioners, 1860; 1875 to 1877 he was a member of Congress. He was a member of the State Constitutional Convention of 1872. President Lincoln in 1861 appointed him commissioner under the convention with New Granada. He published 'Genealogy of Leavenworth Family' (1873).

LEAVENWORTH, Kan., the county-seat of Leavenworth County and one of the most important cities in the State, 26 miles northwest of Kansas City, on the west bank of the Missouri River, here spanned by two fine iron bridges, accommodating railway and ordinary traffic. The Missouri Pacific, Union Pacific, Atchison, Topeka and Santa Fé, the Chicago, Burlington and Quincy, the Chicago, Rock Island and Pacific, and the Chicago Great Western railroads enter the city. It is the eastern terminus of the Leavenworth and Topeka Railroad and is on the line of the Kansas City Northwestern Railroad. Leavenworth was founded by the «Sons of the South» in 1854, and the following year received a city charter. It derives its name from Fort Leavenworth north of the city, the oldest and most important military post on the Missouri River, built in 1827. Prior to the Civil War it was an important trading point and it was at Leavenworth that most of the wagon trains across the prairies were outfitted. The city is the trade centre for a farming and coal-mining region, an inexhaustible coal deposit underlying the city at a depth of 700 feet, giving employment to over 1,000 miners, and yielding 60,000 bushels of coal daily. Besides its coal mines, the manufacturing industries are correspondingly extensive and include flour mills, iron foundries, refrigerating plants, manufactures of mill machinery, mine machinery, stoves, steam engines, furniture, brooms, wagons, light and heavy trailers, farming implements, road machinery, bridge and structural iron and steel, washing machines, soap and chemicals, paper bags and containers, ice, candy and cereal foods.

The city, which is protected from inundation by a limestone stratum, is well laid out, electrically lighted, has an excellent water supply, and a complete system of electric street railroads, connecting with Fort Leavenworth on the north, and the National Soldiers' Home and Lansing Prison on the south. There are 32 churches of all denominations, two hospitals, Cushing and Saint Johns, three theatres, three national banks and three savings and State banks. Mount Saint Mary's Academy for Girls is located three miles south of the city and the school system of Leavenworth is one of the best in Kansas. It is the seat of a Roman Catholic bishop and has a fine cathedral.

The western branch of the National Home for Disabled Volunteer Soldiers is located three miles south of Leavenworth. It comprises 640 acres of beautifully kept grounds, equipped with the most modern housing, amusement and welfare conditions, for accommodation and entertainment of its 3,000 inmates. The Army Service Schools of the United States army are located at Fort Leavenworth in a magnificent building with a separate library building. The permanent capacity of Fort Leavenwoth is approximately 5,000 officers and men and temporary cantonments were erected during the Great War to accommodate approximately 3,000 more. The Disciplinary Barracks or Military Prison is located at Fort Leavenworth and in 1918 had approximately 4,000 inmates with the capacity of nearly twice that number. The Farm Colony of the Disciplinary Barracks maintains a herd of pure-bred Holstein Friesian cattle which is one of the best herds in the West. It also has a chicken ranch which in 1918 produced approximately 30,000 pure-bred chickens. A pure-bred Duroc Jersey swine herd is maintained by the Farm Colony on the large farm which is operated by them. The Colony also has several large greenhouses and the prisoners engage in both diversified and intensive farming and while learning these useful agricultural trades are earning the right to reinstatement in the army and honorable discharge therefrom. The Farm Colony established in 1918 an experimental department operated in co-operation with the Kansas State Agricultural College and the Leavenworth County Farm Bureau for the purpose of experimenting in new crops. This is probably the largest development of the Farm Colony idea for prisoners in the United States. The Federal Prison occupies a corner of the Reservation and is the largest Federal Prison maintained in the United States and in 1918 had approximately 2,500 inmates engaged in general mechanical work. This prison has the most modern equipment and has night schools with extension courses from the Kansas University and the Kansas State Agricultural College. A very large bronze statue of Gen. U. S. Grant is located just north of the city on the military reservation and is said to be one of the best statues of Grant in existence.

During the Great War a Community House for the entertainment of soldiers was opened in the city of Leavenworth and successfully maintained during the period of the war. This afforded clean and wholesome amusement for the soldiers stationed at Fort Leavenworth and gave them an opportunity to meet the better element of citizens. In November 1917 the city voted bonds for the erection of a permanent Community House to be used as a civic centre and school. The management of this building was placed under the Board of Education and the general purpose of it is to provide a place for the holding of all sorts of civic and public activities and the discussion of civic problems and the development of civic projects.

The city government of Leavenworth is administered on the commission plan since 1909, Leavenworth being one of the first cities in the State of Kansas to adopt that form of government. Pop. (1910) 19,363; (1918) est. 25,000. Consult Burke and Rock, 'History of Leavenworth' (Leavenworth 1880).

LEAVES, in the ordinary sense of the word, are the structures on which devolves the duty of nourishing the plant. They invariably arise as lateral protuberances from the growing-points or terminal vegetative cones of the shoots, that is, from a part of the plant which is still in an embryonic condition. In cases where a leaf seems to arise from an older part of a plant, as from the trunk of a tree, close inspection shows that it is really developed from a shoot perhaps not readily visible. Its growth is first at the apex, but this soon ceases, and is followed by continuous enlargement throughout the tissues, by which the upper part or blade of the leaf is soon distinguished from the basal part, and the stalk or petiole (where present) is subsequently formed between them. The development may result in a variety of structures, some of which are far different from typical foliage-leaves, yet are strictly homologous; such are scale-leaves, bracts and the parts of a blossom (floral leaves). The higher the rank of the plant in the scale of development the more these diversities are manifested; and the observations here to be made apply mainly to the phanerogams from the ferns (q.v.) upward.

Leaves collect from the atmosphere the great essential of plant-food, carbon, and conduct the processes of its assimilation, or, in other words, apply it by chemical conversion to the vitality and growth of the plant. In order to understand how they perform this function it will be necessary to investigate their structure and properties. Each leaf is composed of three parts, an outside layer on each surface of compact, flattened, and usually colorless cells, forming a skin or epidermis; an inner part (mesophyll) consisting of irregular cellular tissue and intercellular spaces. These cells of the mesophyll contain minute bodies (chloroplasts) of green coloring matter called chlorophyll, which also abounds in the bark of the stems of herbs and all other green parts of plants, and is the working element in their composition. Through the spongy mesophyll extends the network of veins which form the skeleton of the leaf, and are at once its support and its channels of communication with the other parts of the plant; these form the third part of the leaf. One other important feature must be mentioned — the breathing-pores, or stomata. These are excessively minute openings in the epidermis, which occur wherever chlorophyll lies underneath, but are most numerous on the under or earthward side of the leaves, where, on the average, about 60,000 may be counted per square inch of surface, although in some leaves they are six or eight times as numerous. Each of these pores lies between the "guard-cells" which form an automatic valve, opening or closing the pore, by their swelling or shrinking, according to varying conditions and the requirements of plant-health, especially in respect to evaporation. The chlorophyll grains (chloroplasts) also change their positions in the cells so as to take all possible advantages of a weak illumination, or to guard against a bad effect from excessive light.

Of the 10 essential elements of plant-food nine are drawn from the soil by means of the roots, but the tenth, which is the most important and the largest in amount of all, is obtained by all green plants solely from the carbonic acid of the atmosphere and is taken up by the green leaves alone; also a little of the oxygen required. The air enters the stomata, is seized, as it were, by the chlorophyll, and within it is so decomposed (in a manner not yet explained) that the carbon is chemically extracted and is transformed into plant-food and plant-substance, that is, is assimilated; and botanists restrict their use of the term "assimilation" to this physiological absorption of carbon alone. In order to be able to do this work, however, the leaves require the aid of sunlight, without which the chlorophyll becomes inactive, and in total darkness a green plant will speedily die of starvation, however rich may be the soil in which it is rooted. The "rest" of plants at night is thus accounted for; and also the greater rapidity of growth in northern plants where in summer they enjoy more hours of sunlight each day than southern plants get.

But the service of leaves in the nutrition of the plant does not cease here. They perform a most important function in the transpiration of water. Plants must always draw from the soil a quantity of water far in excess of their needs, or of their capacity to hold, in order to get a sufficient supply of the mineral food dissolved in it, but in exceedingly small quantities; and after that sustenance has been extracted the extra useless surplus of water must be got rid of. This is accomplished through the stomata of the leaves, out of which water is always passing in gaseous evaporation or sometimes even in globules. A secondary but most important accompaniment of this is the suction thus formed, by which the constant up-flow from the root-ends is maintained.

A third essential office of leaves is as the lungs of the plant, which must breathe in essentially the same manner and for the same purposes as does an animal; that is, they must take up oxygen and give off carbonic acid. This independent process (the converse of the simultaneous assimilation) is carried on steadily by all plants, night and day; but in those having leaves it is mainly performed by these organs, because they spread the greatest surface.

In addition to these foremost and general services, leaves are adapted in particular cases, almost as numerous as the plant species, to such special purposes as a depository of food for the young plant in the cotyledons or seed-leaves; as bulb-scales in plants like the hyacinth and lily, where part of the nourishment in the foliage of one year is stored up in the scales or subterranean thickened leaves, for the early growth and flowering of the next year; as bud-scales, forming the protective coverings of buds, as tendrils, pitchers, fly-traps, etc.

These complicated requirements and duties, under varied conditions and circumstances, have produced the extraordinary modifications of form and texture which leaves present, and which must now be briefly considered.

Forms and Arrangement of Leaves.—The typical and ordinary foliage leaf is a thin, flat structure composed of stalk (petiole) and blade (lamina) of symmetrical form, and growing in the plane of the horizon, so that one side (the dorsal) is presented upward to the sky and sunshine, and the other (ventral) is downward and in shadow; and these sides usually present appropriate differences in texture, the upper surface being usually more smooth and compact than the lower. A great variety of textures, from smooth, polished or waxy, to rough, downy or spiny, are distinguished by botanists and used in the description of plants; these variations of surface are largely defensive in their character. Some leaves have no stalk and are said to be sessile, in which case the base of the leaf may partly clasp or completely surround the stem, or be otherwise modified;

similarly the stalk takes many forms, sometimes with two lesser subsidiary leaves (stipules) at the base. The rigid woody centre of the stalk may continue straight on through the middle of the leaf to its apex, forming a midrib which throws out branches alternately on each side toward the margin of the blade, each again branching repeatedly and connecting with its neighbor, and so forming a network or skeleton of woody fibres which strengthen and support the leaf. These ribs are called veins or nerves, and the whole is the «venation» of the leaf. Such a simple leaf (for example of the beech) is called reticulate or net-veined. In a large class of cases, however, the branches of the midrib do not spring at approximately equal intervals along its length, but all diverge from a point near its base, making a palmately veined arrangement, as in the maple. This reticulate veining is characteristic of dicotyledons. In another very distinct type of venation, characteristic of monocotyledons, there is no midrib, but the stalk divides at the base of the blade into many equal veins which extend in a more or less curving line through the length of the leaf, converging at the apex; such a leaf is said to be parallel-veined, as in grasses. Upon the plan of the skeleton depends mainly the form of the leaf, of which a great number of variations are named in botanical manuals and used in descriptions of species, depending mainly on the character and extent of the indentation or incisions.

The arrangement of leaves upon the plant is an important matter. That it follows certain regular plans is apparent in buds, which when cut across exhibit their young leaves packed together in one or another of certain definite ways; and their relative position on the stem of an herb or the twig of a tree follows as a result of the law of growth in that group. The theoretical perfection of arrangement, however, is often greatly disturbed by the interference of older leaves with the development of the younger, and by other causes affecting the unsymmetrical growth of the whole plant. The arrangement of leaves upon the stem, called *phyllotaxis,* is in most cases one of alternation, thus securing the uninterrupted exposure of the upper surface of the leaf to the sun. It is to obtain this exposure that plants struggle to become tall and bear their leaves most profusely at the summit; and that the branches of trees reach outward as far as possible; and the lower early leaves of many soon die off because shaded by the later, higher growth. The arrangement is carried out in two principal ways: the leaves are either alternate, one after another, only a single leaf arising from each node or joint of the stem; or opposite, when there is a pair of leaves on each joint of the stem; but sometimes the leaves are whorled or verticillate, there being three or more in a circle on one joint of the stem. The result of this arrangement in an alternate-leaved stem is to cause the leaves to follow one another up the stem in a spiral manner; while any two successive leaves on the same species will also be separated from each other by just and equal portion of the circumference of the stem. The same principle governs the parts of the flower in which the sepals of the calyx typically alternate with the petals of the corolla, the petals with the stamens and the stamens with the pistils, but it is often disguised in a very puzzling way, especially by the absence of one or more series of organs. See FLOWER.

Modifications of Leaves.— Leaves exist in other forms than the typical ones of foliage. Scales, such as those which envelop and protect buds in winter, and the seeds in cones, are leaves of simple structure which have no assimilative powers or functions; they most frequently originate from an enlarged leaf-base upon which a proper leaf never develops. Bracteal leaves, or bracts, are of similar character and grow beneath and about the flowers, of which, when they are colored, they often form the most conspicuous part; but frequently they are green and are connected with true leaves by intermediate forms. Both scales and bracts have been forced, under experimental conditions, to develop into true leaves.

The modified leaves which form the flowers of phanerogams are termed «floral leaves,» and, as has been said, typically succeed one another in whorls from below upward, as sepals, petals, stamens and carpels. The sepals are usually green and much like foliage-leaves; the sepals often retain a likeness, but the interior whorls usually bear no resemblance to leaves, yet occasionally, in ill-health, revert to a shape which betrays their origin and genetic history.

Periodicity of Leaf Growth.— Leaves are a temporary part of the plant, arising and disappearing at more or less regular intervals, usually once a year. This is especially noticeable in the higher plants, some of which (annuals) die in autumn completely, surviving as species only in their seeds; others die down to the roots in the fall and put forth entirely new stems as well as leaves the following spring; while others, as shrubs and tree, die only so far as their leaves are concerned, putting forth new foliage after the stated period of rest. This period is due to the arrival of annually recurring unfavorable conditions of temperature or moisture or both, when the activity of life in the plant is suspended and it ceases to feed or grow. In such a state leaves having no function are needless — in fact often harmful — and in many cases die and fall off in so sudden and conspicuous a manner that we say such trees are deciduous; while others, which we call evergreen, retain most of their leaves in a green condition until gradually replaced by new ones, so that the foliage seems to be perpetual. The brilliant colors of the dying leaves of many trees and herbs in autumn are due partly to chemical changes in the decaying chlorophyll and partly to the exposure of pigment cells previously concealed by the abundance of chorophyll and other features of vital activity. The leaf drops because it no longer receives nourishment from the stem or twig. The cells at its base close up, transmitting no more sap, and in so doing separate from those in the base of the leaf, which is thus cut off and thrown away.

Bibliography.— The morphology, genesis and functions of leaves have been studied most deeply by German students, as Haeckel, Fritz Müller, Göbel, Schwender, Marchlewski, Fisher and others. These and other authorities have been well summarized in the English translation by Porter of Strasburger's 'Textbook of Botany' (1903). For the forms and nomenclature of leaves, consult the botanical manuals and textbooks of Gray, Wood and other American authors. Consult also Atkinson, 'Elementary Botany' (New York 1898); Coulter, 'Plant Structures' (ib. 1900); id., 'Elementary Studies in Botany' (ib. 1913); Ganong, 'The Living Plant' (ib. 1913).

ERNEST INGERSOLL.

LEAVES OF GRASS, a collection of poems by Walt Whitman (q.v.), published in 1855.

LEAVITT, Erasmus Darwin, American mechanical engineer: b. Lowell, Mass., 27 Oct. 1836; d. Cambridge, Mass., 11 March 1916. He was self-educated, receiving an honorary D.Eng. from Stevens Institute in 1884. He worked his way up through various machine shops and in 1860–61 was chief draughtsman for Thurston, Gardner and Company, Providence. He was assistant engineer in the United States navy in 1861–67, but resigned and resumed his practice, specializing in pumping and mining machinery. He was consulting engineer for the Calumet and Hecla Mining Company in 1874–1904, when he retired. He acted as consulting engineer at various times for the cities of Boston and Louisville, and for private concerns. He was a member of various engineering societies, and in 1883 was president of the American Society of Mechanical Engineers.

LEAVITT, lĕv'ĭt, **Joshua,** American editor: b. Heath, Mass., 8 Sept. 1794; d. Brooklyn, N. Y., 16 Jan. 1873. He was graduated at Yale College in 1814 and was admitted to the bar in 1819. In 1825 he graduated at Yale Divinity School and in 1831 became editor of the New York *Evangelist*. He was an active member of American Anti-Slavery Society in 1833, and from 1837 to 1840 was editor of the society's journal, *The Emancipator*. He was an active promoter of the «Liberty» and «Free Soil» parties. In 1848 he became one of the editors of the *Independent*, retaining a position there until his death. He compiled 'The Christian Lyre' (1834).

LEAVITT, Mary Greenleaf Clement, American temperance advocate: b. Hopkinton, N. H., 22 Sept. 1830; d. 5 Feb. 1912. She was graduated at the West Newton State Normal School in 1851, and in 1857 was married to Thomas H. Leavitt. She taught in various district and grammar schools and in 1867–81 conducted a private school for young ladies and children. She was one of the organizers of the Boston Women's Christian Temperance Union, was a member of the state board of executives and later was national lecturer. In 1883–91 she was secretary of the world's W. C. T. U. and traveled in Europe, Australia, Asia, Africa, South America and many islands, establishing branches of that organization. She became honorary life president of the world's W. C. T. U. in 1891. She was a contributor of temperance and purity articles, stories and verse to the periodical press.

LEBAND, lē'bănd, **John,** English Non-conformist divine: b. Wigan, Lancashire, 18 Oct. 1691; d. Dublin, 16 Jan. 1766. He was appointed assistant of the Presbyterian congregation in New Row, Dublin, in 1716 and later became pastor, remaining there all his life. He is famous for his writings in connection with the deistic movement of the 18th century, which, while by many considered commonplace, are of unquestioned importance in the literature of that era. Author of 'A Defence of Christianity' (1733), a reply to Matthew Tindall's 'Christianity as Old as Creation'; 'Divine Authority of the Old and New Testaments Asserted' (1738), in reply to Thomas Morgan's 'The Moral Philosopher'; 'Remarks on [H. Dodwell's] Christianity not founded on Argument' (2 vols., 1741); his most important work is 'View of the Principal Deistical Writers that have appeared in England' (1754–56); 'Discourses on various Subjects,' with a 'Life' prefixed (4 vols., 1768–89).

LEBANON, lĕb'ą-nŏn, Ind., city and county-seat of Boone County, on the Central Indiana Railway and the Cleveland, Chicago, Cincinnati and Saint Louis railroads, about 30 miles northwest of Indianapolis. The first permanent settlement was made in 1824, and the city was chartered in 1875. Its chief industrial establishments are grain elevators, a furniture factory, cabinet factory, separator factory, wheel works, mitten factory, condensed milk plant and canning plant. The government is vested in a mayor, whose term of office is four years, and a council. The waterworks are owned and operated by the city. Pop. 6,668.

LEBANON, Ky., city, county-seat of Marion County, on the Louisville and Nashville Railroad, about 52 miles southwest of Lexington, the capital of the State, and 70 miles south of Louisville. It is situated in an agricultural region, and is the trade centre for an extensive section. The chief manufactures are flour, meal, furniture, wagons and carriages, wheels and hardwood flooring. There are also several tobacco warehouses. A large amount of livestock is shipped from Lebanon. It is the seat of Saint Augustine's Academy, under the auspices of the Roman Catholic Church, and of a public and parish high school and good graded schools. Several churches and the city and county buildings are among the prominent buildings. The city owns and operates the waterworks. Pop. 3,077.

LEBANON, Mo., city, county-seat of Leclede County, on the Saint Louis and San Francisco Railroad, about 55 miles northeast of Springfield. It is situated in an agricultural, fruit growing, dairying and stock raising region and is the trade centre for a large extent of country. Its chief manufactures are flour, machine-shop products, ice, barrels, lumber, bricks and dairy products. Its trade is principally in the manufactured products, livestock, fruit, hay and vegetables. The city, though small, is a well-known health resort because of its mineral springs. The waterworks and electric-light plant are the property of the municipality. Pop. 2,430.

LEBANON, N. H., town, one of the county-seats of Grafton County, on the Mascoma River, a few miles from its junction with the Connecticut River, and on the Boston and Maine Railroad. It is about 68 miles northwest of Concord, the capital of the State. It was settled about 1762, by people from the vicinity of Lebanon, Conn., who named their new home after the Connecticut town. It is situated in an agricultural region, but the extensive water power supplied by the Mascoma River has made it an important manufacturing town. The chief manufactures are woolen goods, machinery, agricultural implements, wooden ware, men's clothing, sash, doors and blinds, snow-shovels, flour, dairy products and lumber. It has large brickyards. Over 1,500 persons are employed in the manufactories. The annual town meeting is still the governing power. Pop. 5,718.

LEBANON, Ohio, village, county-seat of Warren County, on the Dayton, Lebanon and Cincinnati, and the Cincinnati, Lebanon and Northern railroads, about 73 miles southwest of Columbus, 30 miles northeast of Cincinnati and 22 miles south of Dayton. It was laid out as a village in 1802. It is situated in an agricultural region and its industries are connected with farm products. It is the seat of the Lebanon University. It has a Carnegie public library containing about 10,000 volumes. There is one orphan asylum; also many beautiful residences. The village owns and operates the electric-light plant, the gas plant and the waterworks. Pop. 2,698.

LEBANON, Pa., city, county-seat of Lebanon County, on the Cornwall and Lebanon and the Philadelphia and Reading railroads, about 66 miles northwest of Philadelphia and 23 miles northeast of Harrisburg. Lebanon was settled as early as 1700 by German emigrants. The borough of Lebanon was laid out by George Steitz, in 1750, and was first called Steitztown. It was incorporated in 1820 and chartered as a city in 1885. It is situated in the Lebanon Valley, noted for the fertility of its soil; but the largest part of the wealth of the city comes from the quarries and mines of the vicinity. The Cornwall iron mines, about five miles distant from the city, the limestone and brownstone at the base of the mountains, the brick-clay, the iron ore, all contribute to the industrial wealth of Lebanon. Its chief industrial establishments are furnaces and foundries, rolling-mills, steel plants, machine shops, a very large nut and bolt works, chain works, silk factory, cigars and organs. The educational institutions are the public and parish schools, the Lebanon Business College, the School of Telegraphy, and four libraries. It has a large number of churches. Some of the prominent public buildings are the court-house, county-house and post-office. Pop. 19,926.

LEBANON, Tenn., city, county-seat of Wilson County, on the Nashville, Chattanooga and Saint Louis and the Tennessee Central railroads, about 35 miles east of Nashville. It is situated in an agricultural region, and its trade and industries are connected with farming products. Its chief manufacture is that of cedar pencils. It ships large quantities of hay, butter and poultry. It is the seat of Castle Heights Training School, of Lebanon College for Young Women and of Cumberland University, founded in 1842 by the Cumberland Presbyterians. The city has adopted the commission form of government and owns the waterworks and electric-light plants. Pop. 3,659.

LEBANON, Cedars of. See CEDAR.

LEBANON, Mountains of, Syria, two nearly parallel mountain ranges which, commencing at about lat. 34° 25′ N., stretch south-southwest toward Palestine, enclosing between them a valley about 70 miles long by 15 miles wide, now simply distinguished by the name of El-Bukaa, «the valley,» but known anciently by the name of Cœlē-Syria (hollow Syria). To distinguish the two ranges that on the west is called Lebanon, and that on the east Anti-Lebanon; the Arabs, call the former Jebel-Libnan, and the latter Jebel-esh-Shurky. Lebanon, which runs almost parallel to the Mediterranean coast, and at no great distance from it, may be considered as terminating near the coast, a little north of the mouth of the Litani, between Tyre and Sidon. It is the loftier range of the two, and presents almost a continuous ridge without any marked break. Its loftiest summit — Dhor-el-Khodih, in the north, has a height as given by barometer of 10,060 feet. Anti-Lebanon has a much lower average height, and the culminating point of this chain, Herman, has a height of 9,200 feet. The prevailing rock of Lebanon is limestone, of a whitish color, and from this its name, which means «white,» is supposed to be derived, though others ascribe it to the snows which cover it. There are iron and coal deposits, red amber and asphalt. The loftiest summits of Lebanon, presenting lofty precipices and wild narrow gorges, are almost absolutely barren; but at some distance below, vegetation makes its appearance, the pastures become verdant, and, by means of artificial terraces, cultivation is successfully carried on upon rugged slopes where it would otherwise be impossible. The southern part of the valley is drained by the river Litany (Leontes), which has cut through the Lebanon a most beautiful gorge. A narrow gauge railway now runs through the Lebanon to Beirut. The inhabitable districts are occupied toward the north by the Maronite Christians, a hardy and industrious race, and toward the south by the warlike Druses. Numerous villages and convents are to be seen on the sides and summits of the cliffs. The forests of cedar for which Lebanon was anciently celebrated are represented by a few groves on Lebanon, there being none now on Anti-Lebanon. (See CEDAR). The other prevailing forest trees are firs and oaks. The silkworm and the vine are largely cultivated, and olive, fig and mulberry trees abound. Considerable numbers of wild beasts, as the jackal, hyena, wolf, bear and panther, inhabit the glens and higher peaks. Since the massacre of the Christians in 1860, which was followed by French intervention, the Sanjak of Lebanon has been under a Christian governor, nominated by the Sultan subject to the approval of the Great Powers. Pop. about 400,000: 230,000 Maronites, 50,000 Druses and 30,000 of Moslem faith.

LEBANON SPRINGS, N. Y., village, in the township of New Lebanon, Columbia County, on the Rutland Railroad, about 25 miles southeast of Albany. It is in a fertile agricultural region, and is a favorite health resort because of its mineral springs. A community of Shakers (q.v.) who live in the village and vicinity make brooms and baskets and cultivate extensive gardens. They sell considerable garden seed. See NEW LEBANON.

LEBANON VALLEY COLLEGE, a coeducational institution, founded, in 1867, at Annville, Pa., 20 miles from Harrisburg. It is under the auspices of the United Brethren. The college has five courses which lead to the degree of bachelor of arts; and normal, art, music, oratory and preparatory departments. In 1916 there were connected with the school 25 professors and instructors, and 300 students. The college consists of seven buildings, a campus and an athletic field. There are upward of 10,000 volumes in the college library. The plant and grounds are valued at $293,000, the endowment $75,000, and the gross income is about $52,000.

LEBEL, lę'bĕl, **Nicolas**, French soldier and inventor: b. Angers, 18 Aug. 1835; d. Vitré, Ile-et-Vilaine, 6 June 1891. He entered the Military School of Saint Cyr in 1855, served as captain in the northern army during the campaign of 1870, and became director of the Musketry School at Tours, and in 1883 at Chalons. The same year he was appointed member of the commission on securing an improved rifle for the infantry. The commission decided in favor of the small-bore rifle offered by Lebel, and known as the "fusil Lebel," which was introduced into the French army in 1886. He was present as colonel at the battle of Sedan, but sickness cut short his military career, and in 1890 he was placed on the retired list.

LEBENSOHN, lā'bĕn-sōn, **Abraham Bär** (pseud. ADAM), Russian Hebrew poet and grammarian: b. Vilna, Russia, about 1789; d. there, 19 Nov. 1878. He was educated as a Talmudist, became interested in Hebrew grammar at 11, and at 13, in accordance with the prevailing custom, he was married. He lived with his wife's people the ensuing eight years, engaged in teaching and pursuing his studies. He conducted a brokerage business for about 15 years, and spent the remainder of his life in teaching. In 1848–64 he was on the teaching staff of the Vilna Rabbinical School. He early established a reputation as a Hebrew poet and his first volume of verse 'Shire Sefat Kodesh' (1842) was received with enthusiasm as marking an epoch in Neo-Hebrew literature. His was the first work of the new literature to rank with similar literature in western Europe and he achieved a high reputation in the centres of Hebrew learning. He was a rabbinical scholar of note and through his liberal tendencies became known as a leader of the new Judaism. He prepared an article on the condition of the Jews in Russia for presentation to Sir Moses Montefiore on his visit to Russia in 1846 in which he charged the Jews with responsibility for their own troubles, blaming their general ignorance, their lack of skill as artisans, juvenile marriages, the ignorance of the rabbis and teachers, and extravagance for their condition. His remedy was that of governmental intervention. He collaborated with Benjacob in the preparation of a 17-volume edition of the Bible with a translation into German (1848–53). A second volume of his poems was published in 1856 and the third in 1869. He was author of a commentary on Benshew's 'Hebrew Grammar' (1874); an allegorical drama 'Truth and Faith' (1867); 'Poems in the Sacred Tongue,' a complete edition of his verse (3 vols., 1895).

LEBENSOHN, Micah Joseph, Russian Hebrew poet, son of Abraham Bär Lebensohn (q.v.); b. Vilna, Russia, 22 Feb. 1828; d. there, 17 Feb. 1852. He received a modern education, supplemented by his father's teachings and a course in philosophy under Schelling at Berlin. He made translations of Hebrew songs when very young and engaged in the writing of original verse at 16. His life and work were shadowed by the contraction of tuberculosis, which caused his death at 24. He produced verse which ranks above that of his father in beauty and pathos and in felicity and strength of composition, and is generally regarded as one of the most notable Hebrew poets. Among his translations is that of Schiller's version of 'The Destruction of Troy' from the 'Æneid' (1849). Author of 'Songs of the Daughter of Zion' (1851); 'The Harp of the Daughter of Zion' (1870). A complete edition of his works was published in 1895, and translations of his verse have appeared in French, Russian and German.

LEBERT, lā'bĕrt, **Hermann**, German physician: b. Breslau, 9 June 1813; d. Bex, Canton Waadt, Switzerland, 1 Aug. 1878. He studied medicine at the universities of Berlin, Zürich and Paris, and in 1836 engaged in practice at Bex. He spent the winters of 1842–45 in Paris, studying comparative anatomy, lived in Berlin the winter of 1845–46 and settled in Paris in 1846. He was professor of medicine at Zürich in 1853–59 and at Breslau in 1859–74. He specialized in microscopic anatomy, adding appreciably to the knowledge of pathology and biology. He conducted a series of special investigations in the progress of cancer, tuberculosis and scrofula. Author of 'Physiologie Pathologique' (1845); 'Traité Practique des Maladies Scrofuleuses et Tuberculeuses' (1849); 'Traité Practique des Maladies Cancéreuses' (1851); 'Handbuch der Allegemeinen Pathologie und Therapie' (1865); 'Die Krankheiten des Magens' (1878), etc.

LEBERT, Siegmund, German music teacher: b. Ludwigsburg, Württemberg, 12 Dec. 1822; d. Stuttgart, 8 Dec. 1884. He was educated in music at Prague and became a pianist and teacher of music in Munich. In 1856 he, together with Faiszt, Bachmann, Laiblin, Stark and Speidel, founded the Stuttgart Conservatory. While his methods have been superseded as unnecessarily laborious, he numbered many distinguished musicians among his pupils. He received an honorary Ph.D. from the University of Tübingen and the title of professor from the king of Württemberg. Together with his colleagues of the conservatory he published an edition of pianoforte classics; and with Stark he was author of 'Grosse Klavierschule' which went through many editions and was translated into English, French, Italian and Russian. He was also coeditor with Stark of Clementi's 'Gradus ad Parnassum.'

LEBLANC, le'blän, **Maurice**, French novelist: b. 1864. He is a brother of Georgette Leblanc (Mrs. Maurice Maeterlinck). He began his career as a writer of novels and scored his first great success in 1906 when he began writing detective stories. His principal character, Arsène Lupin, enjoys a fame equaled only by that of Conan Doyle's Sherlock Holmes in the field of detective stories, and his work has attained an even greater success than that of Emile Gaboriau, his predecessor in this field. His skill in handling his material has caused him to be compared with Flaubert and de Maupassant. He is a chevalier of the Legion of Honor. All of his later works have been translated into English and have enjoyed a wide vogue on both sides of the Atlantic. Author of ‘Une Femme’ (1893); ‘L'Œuvre de la mort’ (1896); ‘Arnelle et Claude’ (1897); ‘Gueule-rouge-80 chevaux’ (1904); ‘Arsène Lupin’ (1907); ‘Arsène Lupin contre Sherlock Holmes’ (1908); ‘Nouvelles aventures Arsène Lupin’ (1910); ‘Le bouchon de cristal’ (1912); ‘La Confession d'Arsène Lupin’ (1913); ‘Teeth of the Tiger’ (1914); ‘Woman of Mystery’ (1916); ‘Golden Triangle’ (1917), etc.

LEBLANC, Nicolas, French chemist: b. Issoudun, department of Indre, 1742; d. Saint Denis, 16 Jan. 1806. He studied medicine, was appointed surgeon to the Duke of Orleans and, after the Revolution, administrator of the department of the Seine. His name is associated with the process of converting common salt into carbonate of soda, a matter to which he turned his attention in 1786, after the Academy had offered a prize of 2,500 livres for the discovery. His first endeavors did not yield a decisive result, but led to an accidental discovery by Dizé, an assistant of Jean Darcet (q.v.) at the College of France, through which success was attained. Prior to this time soda was obtained from natural deposits and the ashes of marine plants, the supply of which had become insufficient. With the Duke of Orleans and another, Leblanc and Dizé formed a partnership and began to make soda. The Revolution wrecked their enterprise. Despite his patent for 15 years, secured in 1791, Leblanc was compelled by the committee of public safety to disclose the secret of the process, and the manufacture became open to all. After years of poverty and fruitless efforts for redress, he committed suicide. The discovery of the essential features of the process was assigned to him in 1855 by a commission of the Academy, although the claim of Dizé was strongly advocated. As to the value of the process itself there is no doubt. It has made soda cheap, thereby facilitating the manufacture of soap, the cleansing and bleaching of cloth, etc.; has promoted the manufacture of sulphuric acid, and thereby the utilization of metallic sulphides; and has originated the manufacture of chlorine and of bleaching-powder. The Leblanc soda-process is still in extensive use, but is now dependent more on its by-products than on its output of soda One-half of the world's soda is now made by the ammonia-soda or Solvay process. See SODA.

LEBON, lĕbŏṅ', **Felix Frédéric Georges,** French general and tactician: b. Paris, 1845; d. 1907. He was educated at the École Polytechnique and the École d'Application de l'Artillerie et du Génie, and was a lieutenant in the Franco-Prussian War. He was promoted regularly, receiving rank as general of division in 1902, and was generally recognized as an authority on artillery tactics. He became a member of the superior council of war in 1907. He was a Commander of the Legion of Honor and was the recipient of many foreign decorations. Besides writing numerous articles on artillery tactics and the use of explosives, he collaborated on the *Revue d'artillerie*.

LEBRET, lĕ-brā', **Georges,** French politician: b. Etampes, 1853. He received his LL.D. at Paris and in 1879 was commissioned by the Minister of Public Instruction to investigate and make a report on leases and on agricultural laws and customs in England and Scotland. He was professor of civil and criminal law at the University of Caen in 1885–91, and was then appointed professor of financial legislation there. He served in the House of Deputies in 1893–1902, and in 1898–99 he was Minister of Justice. In 1902 he returned to Caen as professor of civil law. He edited the *Revue critique de legislation et de jurisprudence* and was a recognized authority in its field. Author of ‘Etude sur la propriété foncière en Angleterre’ (1882)

LEBRIJA, lā-brē'ḥa, Spain, city in the province of Seville, 44 miles southwest of Seville, on the left bank of the Guadalquivir and the eastern border of marshes called Las Marismas, and on the Seville-Cadiz Railway. It has a ruined Moorish castle and a church which was originally a mosque, and which exhibits a combination of Moorish, Gothic and Roman architecture. There are deposits of clay which supply manufactures of bricks, tiles and earthenware, and the city has a trade in stock and country produce. Lebrija was settled by the Greeks and is the Roman *Nabrissa* or *Nebrissa*. It was a flourishing town under the Moorish domination and was captured by Saint Ferdinand in 1249, but was lost. It remained Christian under the Castilian crown from the time of its capture by Andrew the Wise in 1264. It was the birthplace of Elio Antonio de Lebrija or Nebrija (1444–1522), known also as Nebrissensis, tutor of Queen Isabella and a leader of the revival of learning in Spain, who assisted Cardinal Ximenes in compiling the ‘Complutensian Polyglot Bible.’ Pop. 11,506.

LEBRUN, lĕ-brŭṅ, **Charles,** French painter: b. Paris, 24 Feb. 1619; d. there, 12 Feb. 1690. He was the son of a sculptor, but early turned his attention to painting and became the pupil of P. Perrier and S. Vouet. He was especially attracted by the Italian masters, examples of which he copied in the gallery at Fontainebleau so that in his 15th year his works won the patronage of Cardinal Richelieu. Chancellor Seguier provided means for him to visit Rome, and during his residence there (1642–46) he studied under Poussin, at the same time paying much attention to the antique and the paintings of the early masters In 1646 he returned to France and assisted in founding the Royal Academy of Arts and Sciences, in which he was successively professor, chancellor and in 1683 director. He was also director of the Gobelin tapestry manufactory. In 1662 Louis XIV appointed him court painter, ennobled him and made him curator of his art collections. He was meanwhile engaged in decorating the

Apollo Gallery in the Louvre. In 1668 the king appointed him superintendent of works in the building of Saint Germain. He also decorated with paintings the royal chateau at Sceaux and designed the statues and fountains for the Park, etc. In 1679 he undertook his greatest work, the interior decoration of the palace at Versailles, and in the Great Gallery portrayed the achievements of Louis XIV. Very many paintings of his are still to be seen in the Louvre. His works are characterized by abundant invention and facility of execution; they reflect the spirit of the contemporary Italian school, but are marred by excessive straining after effect, flatness of design and falsity of color tone. His vast canvas, 'Portrait of the Banker Jabech of Cologne and Family,' is in the Berlin Museum. He exercised a despotic influence over the French art of his time. He wrote 'Traité sur la physiognomie' and 'Methode pour apprendre à dessiner les passions.' Consult Generay, 'Le Style Louis XIV' (1885), and Jovin, 'Charles Lebrun, et les arts sous Louis XIV' (1890).

LEBRUN, Charles François, Duc de Piacenza, French administrator: b. Saint Sauveur-Landelin, 19 March 1739; d. near Dourdan, 16 June 1824. He was appointed inspector of Crown-lands, later entered the States-General and the Constituent Assembly, was appointed governor of Seine-et-Oise in 1791, sat in the Council of Five Hundred, of which he was chosen president, and was made third consul by Bonaparte for services on the 18th Brumaire. In 1807 he reorganized the administration of the exchequer, and after a long retirement reentered public life as governor of Holland in 1810. He translated the 'Iliad,' the 'Odyssey' and the 'Jerusalem Delivered.' Consult his 'Memoirs' (1829).

LEBRUN, Marie Louise Elisabeth, French painter: b. Paris, 16 April 1755; d. there, 30 March 1842. She was trained under Doyen, Joseph Vernet and Greutze, and chose portrait painting as her specialty. She left a great number of portraits in oil and pastel. About 600 are identified as her works of which the most important are her portrait of herself with her little daughter (in the Louvre); her portrait of herself in the Uffizi Gallery at Florence; Marie Antoinette with her three children (in the museum at Versailles). In 1783 she was elected a member of the Academy. During the French Revolution she took refuge in the various European capitals, where she painted portraits of the reigning princes and members of their families, as well as of the most famous people of the time. Few works of hers are to be met with except in private collections. She published 'Souvenirs de ma vie' (Paris 1837).

LEBRUN, Ponce Denis Ecouchard, called **LEBRUN-PINDAR,** French poet: b. Paris, 11 Aug. 1729; d. there, 1807. His title "Pindar" is due to the form and the mythological allusions of his odes, not to any great poetical merit, either in them or the lyrics, and as a satirist he alternately groveled before and libeled the same men. His best odes are addressed to Buffon. He excelled in the composition of madrigals and epigrams; the latter relate for the most part to his quarrels with other authors.

LECCE, lĕt'chā, ancient Lycia, or Lupia, southern Italy. The town is situated in the province of Lecce, on a plain between the Adriatic on the north, the Gulf of Taranto on the west and the Ionian Sea on the south. It has many interesting edifices, especially churches and convents, some of which contain admirable works of art. At the gate of Saint Biagio is a triumphal arch erected in commemoration of the entrance of Charles V. There is a public library and there are well-established day and evening schools and numerous charitable institutions. It is the centre of a productive agricultural district, and has potteries, wool and soap and important tobacco industry. Lecce was very flourishing during the Roman period, escaped the barbarians and in 1000 A.D. was governed by its own counts. Pop. 36,200.

LECCO, lĕk'kō, Italy, capital city of the province of Como, at the exit of the Adda from the Lake of Lecco, the southeastern arm of Lake Como, 16 miles northeast of Como and 32 miles by rail north of Milan. The city is reached by steamer from Como and is 673 feet above sea-level. There is a mediæval stone bridge over the Adda at this point, built originally in 1335 and renewed in 1609. While an ancient town, Lecco is modern in its buildings. It is noted for its excellent schools, and possesses a modern hospital, public library and similar institutions. It has been described in Alessandro Manzoni's 'Promessi Sposi,' and a statue has been erected to the author by the city. There are manufactures of silk and cotton stuffs, wax-candles, iron and copper works, brass foundries, olive-oil mills and wood-carving. The town was presented to the bishops of Como in the 11th century, came into the possession of the archbishops of Milan in the 12th century and in the 13th century it was destroyed by the Visconti. In the 14th century it was fortified and the famous bridge across the Adda was built to unite it with Milanese territory. It was made a countship in 1647. Pop. 12,146.

LECCO, Lake of (It. *Lago di Lecco*), the name given to the southeastern arm of Lake Como in Italy. Some of the large streams of the northern part of Italy flow into Lake Lecco. The town of Lecco and many pretty villages are on its shores.

LECH, lĕh, a river which has its rise in the Alps, in Vorarlberg, Switzerland, at an altitude of over 6,000 feet, flows east and north until it enters Bavaria, after which its course is almost directly north to Donauwörth where it unites with the Danube. Its length is 180 miles. It is not a navigable stream, but it has extensive water power. On this river, near Rain, about five miles below Donauwörth, Tilly was defeated and killed, 5 April 1632, by a Swedish force under Gustavus Adolphus.

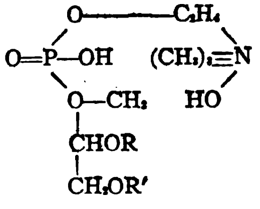
LECHE, lĕ-chĕ, in zoology, the *Onotragus leche,* from South Africa. It is a water antelope, frequenting damp, marshy places and taking to impassable swamps. It goes in considerable herds, and may be known by the peculiar way in which it allows its horns to recline, almost touching the withers.

LECHEVALIER, lĕ-shĕ-văl'yā', **Jean Baptiste,** French classical archæologist: b. Trelly, Normandy, 1 July 1752; d. Paris, 2 July 1836. He was educated for the priesthood, but in 1784 he became secretary to the Comte de Choiseul-Gouffier whom he assisted in archæological researches in the plains of Troy in 1784–86. During the Revolution he traveled in England, Germany, Denmark, Holland, Sweden and Russia, and after his return to France he was, in 1808, appointed director of the Library of Saint Geneviève. He believed that the site of Troy was on the hills above Bunarbashi, and he also maintained that the 'Iliad' and the 'Odyssey' were written by Ulysses. Author of 'Voyage de la Troade' (1800; Eng. trans. by Dalzel, 'Description of the Plains of Troy'); 'Ulysse-Homère ou du veritable auteur de l'Iliade et de l'Odyssée' (1829), etc.

LECHFELD, lĕk'fĕlt, Bavaria, extensive stony plain south of Augsburg on the west bank of the river Lech. It was the scene of a decisive victory by the forces of Otto II over those of the Hungarians, 10 Aug. 955, resulting in the cessation of the Hungarian forays into Bavarian territory.

LECHFORD, Thomas, American colonial lawyer: d. about 1645. He came to the Massachusetts Bay Colony in 1638 and was the earliest lawyer in Boston. He was regarded with great suspicion by the colonial authorities on account of his profession and the nature of his religious opinions, and he found extreme difficulty in making a living. He, therefore, in 1641, returned to England, where his book, 'Plain Dealing, or News from New England,' was printed in 1642. It is a valuable source of information respecting details of early colonial life, and in 1644 was reprinted with the new title, 'New England's Advice to Old England.' A modern edition, annotated by J. H. Trumbull (q.v.), appeared in 1867.

LECITHIN, lē-cĭ-thin, in chemistry, a name applied to several phosphoretted fatty bodies, of very similar chemical and physical properties, derived from brain substance, nerves, blood, gall, the yelk of eggs, etc., and also from some vegetable substances (maize, etc.), and which appear as constant constituents of the cell substance of organized bodies. They are viscous bodies, insoluble in water, slightly soluble in cold alcohol, but very soluble in boiling alcohol and in ether. From their saturated solution in alcohol they crystallize in radially-grouped needles, which dry up *in vacuo* to a white powder. They may also be crystallized from glacial acetic acid. Every lecithin is a fat containing only two fatty acid radicals, the third hydroxyl group being replaced by neurine in combination with phosphoric acid. The structural formula is



where R and R' are acyl radicals.

LECKY, lĕk'ĭ, **William Edward Hartpole**, English historian: b. Newton Park, near Dublin, 26 March 1838; d. London, 23 Oct. 1903. He was educated at Cheltenham College and at Trinity College, Dublin, whence he was graduated in 1859, and in 1860 published anonymously his first work, 'The Religious Tendencies of the Age' (1860), followed in 1861 by 'Leaders of Public Opinion in Ireland,' dealing with Swift, Flood, Grattan and O'Connell, which appeared under his name in a new edition in 1871. An important 'History of the Rise and Influence of the Spirit of Rationalism in Europe' followed in 1861–65 and ensured him wide reputation as scholar and thinker. His 'History of European Morals from Augustus to Charlemagne' (1869) displayed a profound knowledge though its conclusions were not always sound. His most elaborate and valuable work is a 'History of England in the Eighteenth Century' (Vols. I–II, 1878; III–IV, 1882; V–VI, 1887; VII–VIII, 1890), in which he treats very fully of Irish affairs to the time of the Addington Ministry. In a new edition of this history, published in 12 volumes in 1893, the chapters on Ireland were removed from their original context and arranged in a continuous narrative occupying the last five volumes. This work is in reality a history of civilization for the period covered; treating of the forces contributing to the making of the 19th century England, whether of native or of foreign origin. Lecky's other works are 'Poems' (1891); 'Democracy and Liberty' (1896), in which he arraigns modern British political life, and makes some comments upon Gladstone which once aroused considerable discussion; and 'The Map of Life: Conduct and Character' (1899); 'The French Revolution' (1904); 'Historical and Political Essays' (1908). In 1895 he was elected to the House of Commons as member for the University of Dublin, and in 1897 was sworn of the Privy Council. In politics he was at first a Liberal and from 1886 a Liberal-Unionist with an undisguised aversion to democratic government. He became corresponding member of the Institute of France in 1894, and an honorary member of the Royal English Academy upon its organization. A biographical memoir was published by his wife (London 1909). Consult also Rhodes, J. F., 'William Edward Hartpole Lecky' (in 'Historical Essays,' New York 1909).

LECLAIRE, Edmé-Jean, ĕd-mā-zhŏṅ lĕ-klär, French social scientist: b. Aisy-sur-Armançon, 14 May 1801; d. Herblay, 10 Aug. 1872. At first a farm-worker, then apprentice to a mason, he afterward apprenticed himself to a house-painter in Paris, and in 1827 began the painting business on his own account. He proved remarkably successful, and soon took a leading position in his trade. In 1835 the principle of profit-sharing (q.v.) was proposed to him and in 1842 he began to put it in practice in his own establishment, dividing the amount available in sums proportioned to yearly wages. A mutual-aid society which he formed in 1838 and reorganized in 1853 sustained itself from the latter year on the profits which were shared among the members. In 1864 the right to a division of the funds of the society was superseded by a system of retiring pensions. Leclaire was elected *maire* of Herblay in 1865. In the company which he founded his plan of distribution is still adhered to with continued success.

LECLERC, lĕ-klăr, **Charles Victor Emmanuel**, French general: b. Pontoise, 17 March 1772; d. San Domingo, 2 Nov. 1802. He entered the cavalry service in 1791 and was aide-de-camp to General Lapoype. At the siege of Toulon he won the interest of Napoleon, who thereafter held him in high regard. Leclerc accompanied Napoleon as his adjutant in the Italian campaign of 1796, and in 1797 he was married to Napoleon's sister Pauline. He served in the Egyptian campaign, receiving rank as general of division, and he afterward was engaged at Fleurus and Hohenlinden. He was placed in command of the expedition against Toussaint l'Ouverture in 1801 and succeeded in securing the surrender of the negro governor and his forces, but himself fell a victim to yellow fever and died in San Domingo.

LECOCQ, lĕ-kŏk, **Alexander Charles**, French composer: b. Paris, 3 June 1832; d. 1 March 1911. He received his musical education in the Conservatory of the capital, under Bazin and Halévy, and the earliest of his operas to appear was 'Le docteur miracle,' which had won the first Offenbach prize. His operetta 'Fleur de Thé' gained him the widest recognition. In this as in his later productions he followed the advice he had received from Offenbach, that the operetta should be elevated into a work of art. His principal operettas are 'Les jumeaux de Bergame' (1868); 'Gandolfo' (1869); 'Le beau Dunois' (1870); 'La fille de Madame Angot' (1872); 'Giroflé Girofla' (1874); 'La petite Mariée' (1875); 'Kosiki' (1876); 'Le dompteur' (1877); 'Le petit duc' (1878); 'La Rousette' (1881); 'Plutus' (1886), etc. They are 42 in number, and have attained the most remarkable popularity in France and elsewhere.

LECOINTE, lĕ-kwăṅt', **Georges**, Belgian naval officer and scientist: b. Antwerp, 1869. He was captain of the *Belgica* in the Belgian Antarctic expedition of 1897–99, ranking as second in command, and later published valuable reports of the undertaking. He was instrumental in the organization of the International Polar Commission which met at Brussels in 1908, and from 1900 he was scientific director of Belgian Royal Observatory. Author of 'La création d'une marine nationale belge' (1897); 'La navigation astronomique et la navigation estimée' (1897); 'Au pays des Manchots' (1904); 'Mesures Pendulaires' (1907), etc.

LECOMPTON, lĕ-kŏmp'tŏn, Kan., city in Douglas County, on the Kansas River, and on the Atchison, Topeka and Santa Fé Railroad, about 15 miles east of Topeka. It was settled in 1854 by sympathizers with the slavery side of the question which was then before the people, in relation to the admission of new States. Lecompton was the headquarters of the pro-slavery men, and it was here that the Lecompton Constitution (q.v.) was framed, in the fall of 1857. Until 1903 it was the seat of Lane University, founded here in 1865. The place was named in honor of Judge S. D. Lecomte, one of the early workers in Kansas. The electric-light plant is the property of the municipality. Pop. 386.

LECOMPTON CONSTITUTION, in Kansas history a form of territorial government, adopted by a convention held at Lecompton, Kan., in 1857, the legality of which in both form and action became a matter of dispute and caused national discussion and Congressional action. For several years prior to 1857 the slave question had agitated the territory, and numerous bloody quarrels between the Free State settlers and the Missourians who came across the border into Kansas added fuel to the strife. In June 1857 the territorial legislature, composed entirely of pro-slavery men, chosen at an election at which the Free-State men had declined to participate on the ground of its illegality, met at Lecompton, and among other acts passed one providing for the election of a convention to frame a State constitution for Kansas. Meanwhile Congress had passed a bill declaring void all the enactments of the Kansas legislature on the ground that they were cruel and oppressive. The election for delegates to the constitutional convention was held 15 June, but the Free-State men took no part in it. Only 2,000 votes were cast, while the legal voters in the Territory numbered 10,000. The constitutional convention met at Lecompton in November and adopted a constitution, four sections of which related to slavery, declaring the rights of owners to their slaves to be inviolable and prohibiting the legislature from passing acts of emancipation. This provision alone was to be submitted to the people at an election to be held 21 December. The ballots cast were to be endorsed: "Constitution with slavery," or "Constitution with no slavery," thus securing in any event the adoption of a constitution, several clauses of which, besides those submitted, were highly objectionable to a majority of the people. A provision was inserted preventing any amendment to the constitution previous to 1864. The promulgation of this constitution caused great excitement in Kansas.

At the election 21 December the vote returned was 6,143, more than one-half of which was from the counties along the Missouri border, whose total number of voters by the census did not exceed 1,000. Against the slavery clause there were but 569 votes, the Free-State men generally abstaining from voting. The constitution being thus nominally adopted, an election for officers under it was to be held 4 January. At a special session the legislature passed an act submitting the Lecompton constitution to the direct vote of the people on the same day with the State election, and the result was 10,226 votes against it. Congress after a long discussion referred the matter to the people of Kansas at an election on 3 Aug. 1858, when the Lecompton constitution was again rejected by 10,000 majority. Meanwhile the territorial legislature had called another convention to meet in April to frame a new constitution, which was submitted to the people and ratified by a large majority, though by a small total vote. The territorial legislature met in January 1859 and passed an act submitting to the people the question of calling still another constitutional convention. Delegates were elected, and at a convention which met from 5 July to 27 July a constitution was finally adopted which prohibited slavery. This was ratified by a majority of 4,000 at the election 4 October, and the slavery question was at last settled and Kansas was admitted to the Union as a State, 29 Jan. 1861. See also KANSAS; SLAVERY.

LECOMTE, Paul Henri, French botanist: b. Saint Nabord, Vosges, 8 Jan. 1856. He engaged in teaching botany and in 1906 became professor at the Museum of Natural History. In 1897 he founded the *Revue des Cultures Coloniales,* and for some time served as its editor. He was author of several elementary textbooks and 'Les textiles végétaux des colonies' (1895); 'Le cacao' (1897); 'Le café' (1899); 'Le coton en Egypte' (1904); 'Anacardiares de l'Afrique occidentale' (1905); 'Flore générale de l'Indo-China,' etc.

LECONTE DE LISLE, Charles Marie René, shärl mä-rē rė-nā lė kônt dė lēl, French poet: b. Saint Paul, Ile de Bourbon (now Réunion), 23 Oct. 1818; d. Louveciennes, 17 July 1894. When a young man he went to France, studied law at Rennes and after a course of travel settled in Paris. His progress was slow, but gradually he gathered a group of young writers, and expanded his own work, whereby he won recognition as leader of the modern Parnassian school of poetry. It was some years before he found a publisher for 'Poèmes antiques' (1852), his first volume of real significance, but with 'Poèmes barbares' (1862) he gained an academic prize of 10,000 francs. In 1884 he published 'Poèmes tragiques,' and in 1895 appeared 'Derniers poèmes,' a posthumous volume containing also critiques on his precursors in lyric poetry. His hand gave its impress to 'Le Parnasse contemporain,' a series of volumes published in 1866, 1869 and 1876, which is representative of his school, and in these some of his own most notable work was first seen. He also rendered valuable service to French literature by his superior translations of the 'Iliad' (1867); 'Hesiod' (1869), the 'Orphic Hymns' (1869); the 'Odyssey' (1870); 'Horace' (1873); 'Sophocles' (1877) and 'Euripides' (1885). In imitation of the Greek he wrote the dramas 'Les Erinnyes' (1872) and 'L'Apollonide,' based on the 'Ion' of Euripides. His poetry embodies a philosophy of human life in which he sought to combine art with scientific principles and to weave in one poetic fabric the mythical past with ideal visions yet to be realized by the race. In 1887 he was elected a member of the Academy.

LECOT, lĕ-kō, **Victor Lucien Sulpice,** CARDINAL, French Roman Catholic clergyman: b. Montescourt, 8 Jan. 1831; d. Chambery, 19 Dec. 1908. He was educated at the Petit Séminaire at Compiègne and at the Grand Séminaire at Beauvais. He served as chaplain in the French army in the Franco-Prussian War and in 1886 was consecrated bishop of Dijon. He became archbishop of Bordeaux in 1890 and cardinal priest of Santa Pudenziana in 1893. He protested against the Church Separation Law of 1901, but endeavored to persuade the Pope to sanction a compromise.

LECOUVREUR, lė-koov-rėr, **Adrienne,** French actress: b. Damery, Champagne, 5 April 1692; d. Paris, 20 March 1730. Arriving at Paris in her 10th year she made her first theatrical venture three years later, and was immediately engaged for the theatre at Lille. For the following 10 years she was "on the road" as member of various traveling companies, but in 1717 was called to the Comédie Française, and made her début as Electra in Crebillon's tragedy. Her simple and natural impersonation made a deep impression on the most fastidious of audiences, and from that time she played the rôle of most of the heroines in Corneille and Racine with such success that she was welcomed into the most aristocratic circles of the city and was drawn into correspondence with some of the most intellectual men and women of the day, among whom was Voltaire. During the last 10 years of her life she counted among her admirers Maurice of Saxony, Voltaire and Lord Peterborough. She perished by poison administered by the Duchesse de Bouillon, a jealous rival. This dénouement is the subject of the play 'Adrienne Lecouvreur,' by Scribe and Legouvé. Consult Mouval, 'Lettres d'Adrienne Lecouvreur' (1892).

LECTERN, or LETTERN, the reading-desk or stand on which the larger books used in the services of a church are placed. The most ancient lecterns were made of wood, and elaborately carved. Modern ones have been made of marble or brass, very ornamental in design and of excellent execution. They are sometimes made in the form of an eagle, the outspread wings of which form the support for the volume.

Brass Lectern, Cathedral of Saint John the Divine, New York City.

LECTIONARY (Lat. *lectionarium*), originally a service-book of the church of the Middle Ages, so termed as it contained the lessons (*lectiones*) or passages of Scriptures, read in the church service. The Roman Catholic Lectionary contained the epistles and gospels of the Roman missals, sometimes also all the lessons of the various services in the Church, in which case it was termed the Plenarium. The most ancient known, the Gallican Lectionary, is believed to represent the rite of the ancient Gallican Church. It was published from a manuscript of the monastery of Luxeuil in 1685, by Mabillon (q.v.), who attributed it to the 7th century. It was written in Merovingian characters, it names the festival of Saint Geneviève, and assigns three lessons to each mass, in accordance with the ancient Gallican liturgy.

In the Greek Church the lectionaries consist of lessons from the Gospels, from the Acts and Epistles. The Greek lectionary is called Synaxarion (συναζάριο), and the oldest synaxarion extant is that prefixed to the Codex Cyprius (K), a manuscript of the New Testament which belongs to the 8th century.

The lectionary or calendar of the English Book of Common Prayer was first published in 1559, and contained two lessons, one from the Old Testament and one from the New for daily morning and evening prayer, and special lessons for Sundays and holidays. This lectionary was adopted by the Protestant Episcopal Church of the United States in 1789, but in 1883 the General Convention changed it by revision into the form which it now bears. In accordance with this assignment the Old Testament is appointed to be read through in the course of public worship once a year; the New Testament being read three times in the same period.

LECTISTERNIUM, among the ancient Romans, a sacrifice of the nature of a feast offered to the gods, an evident survival of the idea common in early stages of religious development that divinities actually partook of the offerings presented to them. On occasions of extraordinary solemnity, or in times of public calamity, the Greeks and Romans placed tables with food before images of the gods reclining on couches. According to Livy the first Roman lectisternium took place 354 B.C., when a terrible plague affected the cattle. These sacrificial feasts were of two kinds — ordinary, occurring almost daily, and extraordinary, occurring at intervals, and lasting from three to eight days, or longer. Consult Fowler, W. W., 'Roman Festivals' (London 1899).

LECTOR (reader), a minister of the church who reads the Bible, and other writings of a religious character, to the people. The order of lectors is the second of the minor orders in the Roman Catholic, the first in the Greek Church. The office is now merely looked upon as one of the steps to the priesthood, and only in the office for Good Friday does the missal recognize the functions of the lector. Lectors were consecrated by prayers and sometimes by laying on of the hands for this office; the candidate must have completed the seventh year of his age. They are mentioned by Justin Martyr in the 2d century, and appear to have been proper officers of the Church in the 3d century. The orders in the Roman Catholic Church are bishop, priest, deacon, subdeacon, acolyte, exorcist, reader, ostiarius or doorkeeper See ORDERS, HOLY.

LECTURESHIPS, Endowed. The lecture platform has provided many opportunities for extended influence and instruction. Recognizing their value, many lectureships are endowed, mainly, in connection with various educational institutions. The income from the invested funds is sufficient to pay the lecturer for his work and his expenses. Nearly all the educational institutions of England and America have one or more such lectureships. There is another group of lectureships endowed with sufficient funds wherewith to publish the lectures, and thus make them of permanent value. We confine this article to this smaller group. The majority of these lectureships are theological.

I. **English Lectures.**— The oldest series of lectures was founded as the result of the bequest of Robert Boyle. Dr. Richard Bentley was the first lecturer in the long series which was begun in 1691. The Boyle Lectures are in defense of natural and revealed religion. They are delivered in the Chapel Royal at Whitehall. The power of appointment to the lectureship lies with the bishop of London.

The Bampton Lectures founded by the bequest of John Bampton, canon of Salisbury, were given annually at Saint Mary's, Oxford University, for many years beginning in 1781. They are now given in alternate years, due to the depreciation of the income. The incumbent must be an M.A. from either Oxford or Cambridge University and cannot fill the lectureship twice. The lecturers are chosen by the heads of the colleges of Oxford University. The subjects allowed cover almost the entire range of theology.

The Hulsean Lectures founded by John Hulse have been delivered annually at Cambridge University since 1820. They are confined to a discussion of Christian evidences or biblical difficulties. John Hulse also gave the endowment for a prize essay.

The Congregational Union Lectures were founded in 1831 and began in 1833. They appear at irregular intervals. They are not confined to particular subjects, but are allowed a wide range in the field of theology.

The Cunningham Lectures were founded by Dr. W. Binney Webster to perpetuate the memory of Rev. William Cunningham, principal of Free Church College, Edinburgh. The lecturer is usually selected from the Free Church of Scotland, but not necessarily. They are delivered in Edinburgh and deal with biblical and theological subjects. The first lecture was delivered in 1864 by Robert A. Candlish.

The Fernley Lectures were founded by John Fernley to explain and defend the theological doctrines and polity of the Wesleyan Methodist Connexion. The first lecture was given in 1870. The lectures are given annually before the conference of ministers of the Wesleyan Methodist Connexion.

The Baird Lectures were founded in 1873. The lecturers are selected by the trustees of the endowment fund which amounts to £500,000 ($2,500,000). The lecturers are chosen only from ministers of the Church of Scotland, and ministers of any other Scotch Presbyterian Church. The lectures have largely dealt with biblical and theological subjects and the church history of Scotland.

The Croall Lectures are named after their founder, Mr. John Croall, and are designed to defend and maintain the doctrines of the Christian religion, "and to increase the religious literature of Scotland." The lecturer is preferably chosen from the ministry of the Presbyterian churches of Scotland. The lectures are delivered at Edinburgh and were begun in 1875.

The Hibbert Lectures were founded for the purpose of furthering the study of comparative religion. They are delivered at Oxford and London. The lecturers are not drawn exclusively from England. The first lecture was delivered by Max Müller in 1878.

Lord Gifford founded the lectures which bear his name. They are delivered at the universities of Edinburgh, Glasgow, Aberdeen and Saint Andrews. The first lectures were delivered in 1888. See GIFFORD LECTURES.

The Schweich Lectures dealing with Old Testament subjects have been given at the British Academy, London, since 1910.

The Drew Lectures on Immortality were delivered at Oxford University in 1912 by R. H. Charles.

The Christian Evidence Society maintained a course of lectures for several years.

II. American Lectures.— The Ely Lectures were founded in 1865 by Mr. Zebulon Stiles Ely of New York, and are delivered at intervals under the auspices of Union Theological Seminary in New York. The subjects are all within the range of apologetics.

The Yale Lectures on preaching on the Lyman Beecher foundation were inaugurated in 1872 when Henry Ward Beecher gave the first course before the Yale Divinity School.

The Stone Lectures of Princeton Theological Seminary were founded by Mr. Levi P. Stone of Orange, N. J., in 1871. The first lecture was delivered in 1883 by Mark Hopkins. The subjects are theological.

The bequest of John Bohlen of Philadelphia in 1874 established the John Bohlen Lectureship in connection with Holy Trinity Church, Philadelphia. The lecturers are to confine themselves to the subjects discussed by the Bampton lecturers.

The Lowell Lectures are given from time to time under the auspices of the Lowell Institute of Boston, Mass. A course was given by Francis Bowen as far back as the winter of 1848–49. The foundation dates from the bequest of John Lowell in 1836. The subjects include psychology, anthropology, natural theology and apologetics.

The Mendenhall Lectures are given at De Pauw University, Greencastle, Ind., and deal with some phase of the «Divine origin, inspiration and authority of the Bible.» They were founded by the bequest of Marmaduke H. Mendenhall, D.D., and were inaugurated in 1915.

The Louis Clark Vanuxem Foundation of Princeton University was named after its donor after the receipt of his bequest in 1879. The lectures are to be on subjects of current scientific interest.

The Bishop Paddock Lectureship was founded in 1880 by Mr. George A. Jarvis of Brooklyn, N. Y., in loving memory of his former pastor and friend, Rt. Rev. Benjamin Henry Paddock, bishop of Massachusetts. They are delivered at the General Theological Seminary in New York city. Their aim is, «to defend the religion of Jesus Christ as revealed in the Holy Bible and illustrated in the Book of Common Prayer against the varying errors of the day.»

Frederick Merrick, for 51 years a member of the faculty of Ohio Wesleyan University, founded the Merrick Lectureship in that institution in 1889. The lectures cover the «general field of experimental and practical religion.»

In 1892 a committee of representatives of several of the leading universities organized 'The American Lectureship on the History of Religions' for «the purpose of encouraging the intelligent study of religion.» The first lecture was delivered in 1895.

The Ingersoll Lectureship, on the immortality of man, was founded at Harvard University in 1893 by the bequest of Mrs. Caroline Haskell of Keene, N. H.

The Barrows Lectures on Christianity are given under the auspices of the University of Chicago and delivered in the Far East. They were founded by Mrs. Caroline Haskell in 1894 as the result of the World Parliament of Religions held in Chicago in 1893. The first course was given in 1895–96 by John Henry Barrows, after whom they are named. In the year 1894 Mrs. Haskell also gave the University of Chicago the Haskell Lectureship on Comparative Religion.

Mr. William Belden Noble of Washington, D. C., founded the William Belden Noble Lectures at Harvard University in 1898. The subjects are to be within the «large interpretation of the influence of Jesus as given by the late Phillips Brooks.»

The Cole Lectures were founded by Col. E. W. Cole and wife of Nashville, Tenn. They are delivered in connection with the Biblical department of Vanderbilt University, and are restricted to «a defense and advocacy of the Christian religion.» The lecturer is nominated by the theological faculty and confirmed by the College of Bishops of the Methodist Episcopal Church, South.

Lake Forest College, Lake Forest, Ill., received from the late lieutenant-governor of Illinois, William Bross (1866–70), funds for the endowment of the Bross Foundation in honor of his son, Nathaniel Bross, who died in 1856. The funds had accumulated so that the first course of lectures was possible in 1903. The subjects are within the range of Christian evidences. The same fund also provides for a prize to be given to the writer of the most important book in a given period, in the same field.

The Hale Lectures were founded in 1900 in connection with Western Theological Seminary of Chicago, Ill., by the bequest of Rt. Rev. Charles Reuben Hale, bishop coadjutor of Springfield. The subjects specified are: «liturgies and liturgics; church hymns and church music; the history of the Eastern churches; the history of the national churches; contemporaneous church history.»

The Nathaniel William Taylor Lectures are given annually before the Divinity School of Yale University and had their beginning in 1903. They deal with the evidences of the Christian religion.

The Norman W. Harris Lectures were founded by the late Norman Waite Harris, a banker of Chicago, Ill. They are delivered at Northwestern University, Evanston, Ill. They were founded «to stimulate scientific research of the highest type.» The first lectures were given by Prof. Borden P. Bowne of Boston University in 1907.

In 1905 Mrs. Caroline E. Haskell of Chicago, Ill., established a lectureship at Oberlin College on «Oriental literature and its relation to the Bible and Christian teaching.» The first lecture was given in 1907.

The George Shepherd Lectures on Preaching are delivered under the auspices of Bangor Theological Seminary, Bangor, Me. The first lectures were delivered in 1904.

There are other courses of endowed lectures in connection with various institutions and societies which do not publish their lectures. All the foundations represented above have published most of the lectures given on the foundation. There are also lectures covering one or more years which we have not included, like the Saint Giles Lectures on Comparative Religion, the Saint Margaret's Lectures and the Ingham Lectures.

Samuel G. Ayres,
Garrett Biblical Institute.

LEDA, lē'dạ, in Greek mythology, the wife of the Spartan king, Tyndareus. In order to enjoy her, Zeus changed himself into a swan, in which form he is represented with her in a picture from Herculaneum. By him she had Pollux and Helen, and by Tyndareus, Castor and Clytemnestra.

LEDA, genus of bivalve mollusk with a small elongated shell concentrically striated, hinged with two rows of small saw-like teeth and an external ligament. It exists in the Silurian time and is still represented by various living species. It is of the *Lamellibranchiata* family and is sometimes classified as of the family *Lediæ*. See Pelecypoda.

LEDESMA BUITRAGO, lā-dĕs'mạ bwē-trā'gō, **Alonso de**, Spanish poet: b. Segovia, 2 Feb. 1562; d. there, 15 June 1632. His work was romantic and highly imaginative, characterized by fanciful exaggerations, and was the foundation of a school of verse-writers known as «*conceptistas*,» named from the first of the poet's books. The works of Quevedo and Lope de Vega are supposed to have been influenced by him. Author of 'Conceptos espirituales' (1600); 'Juegos de nochebuena' (1611); 'Romancero y monstruo imaginado' (1615); 'Epigrams y hieroglíficos á la vida de Cristo' (1625). Specimens of his verse are published in Rivadeneira's 'Biblioteca de autores españoles' (Vol. XXXV, 1872).

LEDOCHOWSKI, Miecislas Halka, mē-ā-kēs'läs häl'kä led-ō-hŏv'skē, Polish Roman Catholic ecclesiastic: b. Galicia, 29 Oct. 1822; d. Switzerland, 22 July 1894. He studied theology and subsequently entered the papal diplomatic service and became papal auditor successively at Madrid, Lisbon, Rio de Janeiro and Santiago de Chile. In 1861 he was appointed archbishop of Thebes, while his appointment to the archbishopric of Gnesen and Posen in 1866 constituted him primate ex officio of Poland. He actively opposed the Prussian May laws by which Bismarck sought to subject the Roman Catholic Church in Germany to state control. In consequence of his opposition, his property was confiscated and himself imprisoned in 1873 for two years. He was created cardinal in 1875 and in 1892 general prefect of the propaganda.

LEDOCHOWSKI, Wlodimir or **Vladimir**, Russian-Polish priest: b. Loosdorf, Galicia, 7 Oct. 1866. He came of a family distinguished in Russia and in Austria, and was educated at the Vienna Gymnasium, the Seminary, Tarnow, Austria, and at the Germanicum, Rome. He entered the order of the Jesuits in 1889 and was ordained in 1894. He became vice-provincial, then provincial for Poland; in 1906 he was elected assistant-general and in 1915 general of the Society of Jesus in central Europe. He was actively connected with various undertakings looking toward a peaceable settlement of the European War.

LEDOUX, lĕ-doo, **Albert Reid**, American mining engineer: b. Newport, Ky., 2 Nov. 1852. He was educated at the Columbia School of Mines and the universities of Berlin and Göttingen. He was State chemist and a member of the State Board of Health of North Carolina in 1876–80, thereafter acting professionally as consulting engineer, metallurgist, assayer and chemist and as an expert in chemistry and engineering cases. He served for two years as expert on the New York Electric Subway Commission. He was president of the American Institute of Mining Engineers in 1903 and is a member of the leading scientific societies.

LEDOUX, Louis Vernon, American poet: b. New York, 6 June 1880. He was graduated at Columbia University in 1902 and became associated with his father's firm, Ledoux and Company, mining engineers and metallurgists, of which he is vice-president. He has devoted considerable time to writing verse and has achieved a considerable success in that line. Author of 'Songs from the Silent Land' (1905); 'The Soul's Progress and Other Poems' (1907); 'Yzdra' (1909); 'The Shadow of Etna' (1914); a lyrical drama, 'Story of Eleusis' (1916); 'George Edward Woodberry, a Study of His Poetry' (1917).

LEDRAIN, lĕ-drăn', **Eugène**, French archæologist: b. Sainte-Suzanne, Mayenne, 1844; d. Paris, 1910. He was educated for the priesthood but devoted himself to researches in Oriental archæology. He was for many years a curator in the department of Oriental antiquities at the Louvre and also served as a professor in the Ecole du Louvre. He was author of 'Un grand seigneur féodal dans la moyenne Egypte' (1876); 'Les momies gréco-égyptiennes ornées de portraits peints sur penneaux' (1877); 'Histoire d'Israël' (2 vols., 1879–82); 'Les monuments égyptiens de la bibliothèque nationale' (2 vols., 1880–81); 'Dictionnaire des noms propres palmyréniens' (1886); 'Traduction de la bible' (6 vols., 1886–90); 'Catalogue des monuments araméens et himyarites du Musée du Louvre' (1888); 'Dictionnaire de la langue de l'ancienne Chaldée' (1897).

LEDRU-ROLLIN, lĕ-drü-rōl-lăn, **Alexandre Auguste**, French political agitator: b. near Paris, France, 2 Feb. 1807; d. Fontenay-aux-Roses, France, 31 Dec. 1874. Admitted to the bar in 1830, he became prominent in the defense of Republican journalists and men of similar views in the reign of Louis Philippe, and later as a democratic agitator and leader of the workingmen's party. On the outbreak of the Revolution of 1848 he became a member of the provisional government as Minister of the Interior, and in May was one of the five in whose hands the Constituent Assembly placed the interim government. But he offended everyone by his arbitrary conduct, and resigned. He was a candidate for the Presidency against Louis Napoleon in the following December, but was ignominiously beaten. An unsuccessful attempt to provoke an insurrection against his rival put an end to his influence, and for the next 20 years he lived alternately in London and Brussels, being amnestied only in 1870. After his return to France he was elected to the Assembly in 1871, and again in 1874.

LEDUM OIL. See LABRADOR TEA.

LEDYARD, John, American traveler: b. Groton, Conn., 1751; d. Cairo, Egypt, 17 Jan. 1789. He entered Dartmouth College in 1772, with a view of fitting himself for missionary duty among the Indians. The restraints of this mode of life proving irksome, he absented himself at one time from college for several months, during which he visited the Indians of the Six Nations; and, finally abandoning the idea of becoming a missionary, he embarked on the Connecticut River in a canoe of his own fashioning and floated down to Hartford. After a brief experience as a theological student, he shipped at New London as a common sailor in a vessel bound for the Mediterranean, and at Gibraltar enlisted in a British regiment, but was discharged at the request of his captain. He accompanied Captain Cook on his third voyage around the world, 1776–80, and of this voyage he kept a private journal, which in accordance with a general order of the government was taken from him on the return of the expedition to England. Subsequently he wrote out from recollection, assisted by a brief sketch issued under the sanction of the Admiralty, an account of the expedition, published in 1783. During the two years succeeding his return to England he remained in the British naval service, but steadily refused to take arms against his native country. In December 1782, he found means to escape. He intended to journey through northern Europe and Asia and after surmounting many obstacles arrived at Irkutsk, where on 24 Feb. 1788 he was arrested by order of the Empress Catherine, conducted with all speed to the frontiers of Poland, and there dismissed, with an intimation that he would be hanged if he re-entered Russia. Ledyard found his way back to London in the spring, and was cordially received by Sir Joseph Banks and others who had befriended him. Undaunted by previous adversities, he eagerly accepted an offer to undertake an expedition into the interior of Africa; and when asked how soon he would be ready to set out, replied: "To-morrow morning." He departed from England in the latter part of June, intending to cross the African continent in a westerly direction from Sennaar, and had proceeded as far as Cairo, when he died. For capacity of endurance, resolution and physical vigor, he was one of the most remarkable of modern travelers. Many extracts from his journals and his private correspondence with Jefferson and others are given in Sparks' memoir of him.

LEDYARD, Lewis Cass, American lawyer and financier: b. Michigan, 4 April 1851. He took his A.B. at Harvard in 1872, and his LL.B. at the Harvard Law School in 1875, afterward engaging in law practice in Boston. He became associated with various corporations, railroads and telegraph companies as a director, was president of the Franklin Building Company and a trustee of the United States Trust Company. He was trustee and vice-president of the New York Public Library, president of the Lying In Hospital and a trustee of the Metropolitan Museum of Art.

LEDYARD, William, American soldier: b. Groton, Conn., about 1750; d. Fort Griswold, Conn., 7 Sept. 1781. He held the commission of colonel in the militia of Connecticut, and during the marauding expedition of Arnold in September 1781 was in command of Forts Trumbull and Griswold, which protected New London. He refused a demand for the surrender of Fort Griswold, and resisted for nearly an hour the attack of a British force numbering 800 men. The command of the attacking force devolved upon Major Bromfield, a Tory, who effected an entrance into the fort after nearly 200 of his men had been disabled, including 48 killed, the Americans having lost about a dozen killed. To Bromfield's inquiry: "Who commands this garrison?" Ledyard replied: "I did, sir, but you do now," at the same time handing him his sword. Bromfield immediately plunged it through the body of Ledyard, killing him upon the spot. A massacre of the Americans ensued, which was not ended until more than 100 of them were killed and wounded. A monument has been erected near the spot to commemorate this event.

LEE, Agnes, American writer, formerly of Boston, now Mrs. Otto Freer, of Chicago, has written many poems for the leading magazines. Several years ago she published a book of poems for children. She has translated into English the poems of Théophile Gautier, Flaubert's 'St. Julien,' Gregh's 'Maison de l'Enfance,' etc. In 1910 appeared her volume of poems, 'The Border of the Lake,' and in 1914 'The Sharing,' a book of her later poems. She has written several poetical plays.

LEE, Albert, American author and editor: b. New Orleans, 11 May 1868. He prepared for college at Exeter where he was one of the founders of the *Phillips Exeter Literary Magazine,* which still exists. He was graduated from Yale in 1891, having during his senior year edited the *Yale Literary Magazine.* In 1891–94 he was on the editorial staff of the New York *Sun*; in 1895 became editor of *Harper's Round Table;* and in 1899 was for a short time associate editor of *McClure's Magazine,* becoming managing editor of *Harper's Weekly* in the same year. In 1901–03 he was associate editor of *Collier's Weekly,* taking the position of managing editor in January 1903. In 1911 he went abroad for a period of travel, and in June 1913 associated himself with Mr. Condé Nast in the starting of the magazine *Vanity Fair,* of which he is now managing editor. He has written 'Tommy Toddles' (1896); 'Track Athletics in Detail' (1897); 'The Knave of Hearts' (1897); 'Four for a Fortune' (1898); 'He, She and They' (1899); 'The Pie and the Pirate' (1910), 'Miss Phoenix' (1912), which he later dramatized and produced at the Harris Theatre, New York, in October 1913.

LEE, Alfred, American Protestant Episcopal bishop: b. Cambridge, Mass., 9 Sept. 1807; d. Wilmington, Del., 12 April 1887. He was graduated at Harvard in 1827, and after studying law practised for three years in New London, Conn. Feeling, however, that his vocation was elsewhere he was admitted to the General Theological Seminary, where he was graduated in 1837. He was elected rector of Calvary Church, Rockdale, Pa. (1838), but on being consecrated first bishop of Delaware in 1841, took charge of Saint Andrew's, Wilmington, the following year. He was a member of the American Committee for Revision of the New Testament (1881) and presiding bishop (1884–87). He is the author of 'Life of Saint Peter' (1852); 'Life of Saint John' (1854); 'A Treatise on Baptism' (1854); 'Harbinger of Christ' (1857); 'Co-operative Revision of the New Testament' (1881).

LEE, Algernon, American journalist: b. Dubuque, Iowa, 15 Sept. 1873. He was educated at the University of Minnesota, and from 1895 was identified with the Socialist movement. He edited the *Tocsin* at Minneapolis in 1898–99, the *Worker* in New York in 1899–1908, and the *Daily Call* in 1908–09, when he became a department editor on the *Metropolitan Magazine*. He was appointed educational director of the Rand School of Social Science in 1909, and in 1904, 1906, 1916 and 1917 was a delegate to the International Socialist conventions. He opposed the sale of War Savings Stamps and invited considerable censure by his hostile attitude toward the conduct of the European War.

LEE, Ann, foundress of the Society of Shakers in America. See SHAKERS.

LEE, Arthur, American diplomatist: b. Stratford, Westmoreland County, Va., 21 Dec. 1740; d. Urbana, Middlesex County, Va., 12 Dec. 1792. He was educated at the University of Edinburgh; entered the practice of medicine at Williamsburg, Va.; studied law in the Temple, London (1766–70); practised in England in 1770–76; closely observed colonial questions; was a member of the society known as "The Supporters of the Bill of Rights," by which ministerial measures were discussed, and in 1770 was appointed associate of Franklin as London agent of Massachusetts colony. When Congress appointed Franklin, Jay and Dickinson a committee to correspond with friends of the colonies in other parts of the world, Lee became secret agent in London of the committee; and in 1776 he was chosen by Congress joint commissioner with Franklin and Deane to obtain a treaty of alliance with France. In 1777 he dispatched special missions to the governments of Spain and Prussia; in 1778 became commissioner to Spain; but in 1779 was recalled owing to his disagreements with Franklin and Deane. He was a representative in the Virginia general assembly in 1781; a delegate to the Continental Congress in 1781–84, and a member of the board of treasury in 1784–89. He opposed the adoption of a Federal constitution. Consult Lee, R. H., 'Life of Arthur Lee' (1829).

LEE, Blair, American legislator and lawyer: b. Silver Springs, Md., 9 Aug. 1857. He was graduated from Princeton University in 1880 and from the Columbian (now George Washington) University in 1882, and was admitted to the bar in Maryland and in the District of Columbia. He was elected to the Maryland State senate in 1905 and in 1909, and on 4 Nov. 1913 he was elected to the United States Senate to fill the term of Senator Jackson, expiring 3 March 1917.

LEE, Charles, American soldier: b. Dernhall, Cheshire, England, 1731; d. Philadelphia, 2 Oct. 1782. In 1751 he entered the English army as lieutenant of the 44th, which he accompanied to America in 1754, and with which he was present at Braddock's defeat on the Monongahela (9 July 1755). He was wounded in Abercrombie's attack on Ticonderoga (1 July 1758), took part in the capture of Montreal in 1760 and was promoted major in 1761. He served in Burgoyne's division in Portugal in 1762, and was for a time busy with a scheme for establishing in America two colonies, one on the Ohio, the other on the Illinois, to be recruited from Switzerland and Germany as well as New England. In 1764 he went to Poland, there was appointed to the staff of King Stanislaus Augustus, in 1766 accompanied the Polish embassy to Turkey, in 1769 as a major-general in the Polish army fought in a campaign against the Turks, and having called his superior officers fools, left the service and returned to England. He was made lieutenant-colonel on half-pay in 1772, but was further unrecognized by the British government, and in disappointment came to America 10 Nov. 1773, and by skilful display of what military knowledge he possessed attracted the attention of the Continental Congress, then eager to obtain competent leaders for the Revolutionary army. His career thenceforth was perhaps the strangest in the annals of the Revolution. He wished to become commander-in-chief of the American forces, but accepted the appointment as second of the major-generals, Artemas Ward (q.v.) being the first. To inspire public confidence he purchased for £5,000 Virginia currency (about £3,000 sterling), an estate in Berkeley County, Va.; but he did not assume his rank until guaranteed by Congress pecuniary indemnity for possible losses incurred in so doing. He undeservedly received popular credit for Moultrie's successful defense of Charleston, S. C. (28 June 1776), and was called the "Hero of Charleston." In 1776 he became first major-general upon the resignation of Ward. He failed to obey when ordered by Washington to cross the Hudson from Westchester County with his 7,000 troops and join the latter in New Jersey; but when Washington was compelled to fall back on Princeton (2 Dec. 1776) crossed the river to Morristown and encamped there with 4,000 troops. Gates marched from Ticonderoga with seven regiments for Washington's aid, but Lee diverted three of the regiments to Morristown. Washington crossed the Delaware into Pennsylvania, and Lee diligently spread reports of the commander-in-chief's incapacity and planned a flank movement upon the British army whose success he intended should secure his own appointment to replace Washington. He was, however, captured at Baskingridge (13 Dec. 1776), and imprisoned at New York, where he deserted the American cause, and designed a plan for the subjugation of the American colonies, the original draft of which was found among the private papers of the Howes in 1857. He was exchanged in 1778, and re-entered the American service for reasons not fully known; but his insubordination at Monmouth (28 June 1778) nearly lost the day, and he was suspended from command for one year. A subsequent disrespectful letter to Congress caused his dismissal from the army. His treasonable correspondence with the British authorities was not discovered till many years after. He wrote 'Strictures on a Friendly Address to all Reasonable Americans' (1774) in reply to Dr. Myles Cooper (q.v.); and made a foolish claim to be the author of the "Junius" letters. Consult the 'Memoirs,' edited from his papers by Langworthy (1792), and Moore, 'The Treason of Charles Lee' (1858).

LEE, Charles, American Cabinet officer: b. Leesylvania, Va., 1758; d. Fauquier County, Va., 24 June 1815. He was a brother of Henry Lee, soldier (q.v.). He was graduated from the College of New Jersey in 1775; studied law in the office of Jared Ingersoll at Philadelphia; practised in Westmoreland County, Va., and sat in the Virginia assembly. On 10 Dec. 1795 he was appointed by Washington Attorney-General of the United States, and this office he filled until the last month of Adams' administration (1801). He declined an appointment by Jefferson as chief justice of the United States Circuit Court for the fourth circuit.

LEE, Eliza Buckminster, American prose writer: b. Portsmouth, N. H., 1794; d. Brookline, Mass., 22 June 1864. She was married to Thomas Lee of Boston, Mass., where the greater part of her life was spent. She was a popular author in her day and among her books are 'Sketches of New England Life' (1837); 'Delusion' (1839); a translation from the German of the 'Life of Jean Paul Richter' (1842); 'Naomi; or, Boston Two Hundred Years Ago' (1848); 'Parthenia; or, The Last Days of Paganism' (1858), and a translation of Berthold Auerbach's 'Barefoot Maiden' (1860).

LEE, Fitzhugh, American soldier and diplomatist: b. Clermont, Fairfax County, Va., 19 Nov. 1835; d. Washington, D. C., 28 April 1905. He was the nephew of Robert E. Lee (q.v.). Appointed as cadet at large to West Point by President Fillmore, he entered the academy at 16, and was graduated in 1856, receiving an appointment to the famous Second cavalry of which A. S. Johnston was colonel and R. E. Lee was lieutenant-colonel. After serving for a year at Carlisle Barracks as cavalry instructor of recruits, he reported to his regiment on the frontier of Texas and was greatly distinguished in several fights with the Indians, being mentioned in the official reports for skill and gallantry. In a fight with the Comanches, 13 May 1859, he was severely wounded, but recovered and joined his command. He led a part of his company in January 1860, in a very notable and successful fight with the Indians, in which he greatly distinguished himself in a single combat with an Indian chief. In November 1860 he was ordered to West Point as instructor of cavalry tactics. When Virginia seceded from the Union he promptly resigned his commission and tendered his services to his native State. He served for a time on the staff of Gen. R. S. Ewell, and in September 1861 he became lieutenant-colonel, and in April 1862 colonel of the First Virginia cavalry. Henceforth he was intimately connected with Stuart's cavalry and won constant reputation for dash, daring and intelligent execution of duty. After the battles around Richmond he was made brigadier-general, his brigade consisting of the 1st, 3d, 4th, 5th and 9th Virginia cavalry and a battery of horse artillery. In the campaign against Pope and the Maryland campaign the cavalry rendered most important service, and General Lee did his full duty in these operations. When Gen. Robert Lee withdrew from Sharpsburg, Fitzhugh Lee's brigade relieved the pickets and held the lines till the army had crossed the Potomac. On 17 March 1863 Averell's division of 3,000 cavalry crossed the river at Beverly's Ford, and attacked him; though he could only put 800 troopers in the saddle, he successfully resisted Averell, and after one of the most hotly contested cavalry battles of the war drove him back across the river. In the Chancellorsville movement he protected Jackson's flank, and made a very important reconnoissance by which he located the flank and rear of the enemy, and enabled Jackson to attack it to the best advantage. In the autumn of 1863 he was made major-general and given command of a division of cavalry. In the campaign of 1864 he rendered important service, holding in check the advance of Grant's army until Gen. R. E. Lee's infantry could occupy Spottsylvania, repelling Sherman's raid on Richmond, defeating Sheridan at Trevillians and Samaria Church, routing Wilson at Reams Station and operating with Early in the Valley, being severely wounded at the battle of Winchester. When Hampton was sent south Lee was given the command of the entire cavalry corps of the Army of Northern Virginia, conducting the retreat to Appomattox, was one of the council of war whom Robert Lee consulted, and one of the leaders in the last charge of the Army of Northern Virginia. He "accepted the situation" after the surrender, and went to work on his farm at Richland. From 1886 to 1890 he was governor of Virginia. In 1896 he was appointed consul-general to Cuba, in which position he kept the State Department thoroughly informed of the Spanish policy during the rebellion, and vigorously upheld the rights and interests of the United States; after the destruction of the *Maine* he did much to prevent the premature outbreak of war with Spain, but when war was inevitable he was recalled. In May 1898 he was appointed major-general of United States volunteers, and assigned to the command of the 7th army corps. At the close of the war he was made military governor of the province of Havana, and later was given the command of the Department of the Missouri. He published 'Robert E. Lee' (1894, in 'Great Commanders' Series), and 'Cuba's Struggle against Spain' (1899).

J. W. Jones, D.D.

LEE, Francis Bazley, American lawyer and historical writer: b. Philadelphia, 3 Jan. 1869; d. Trenton, N. J., 2 May 1914. He was educated at the State Model School in Trenton, N. J., and was graduated from the Wharton School of Political Economy in the University of Pennsylvania in 1890. He was admitted to the New Jersey bar in 1893 and thereafter practised his profession in Trenton. In addition to various historical monographs relating to New Jersey, he is the author and editor-in-chief of 'New Jersey as a Colony and a State.'

LEE, Francis Lightfoot, American patriot: b. Stratford, Westmoreland County, Va., 14 Oct. 1734; d. Richmond County, Va., 3 April 1797. He was elected to the Virginia house of burgesses for Loudoun County in 1765, and later represented Richmond County in that assembly. He signed the Westmoreland declaration against the Stamp Act (1765), and on 15 Aug. 1775 became a member of the Continental Congress, where he served until the spring of 1779. On 4 July 1776 he was one of the 56 signers of the Declaration of Independence. He also was a member of the committee that prepared the Articles of Confederation, and was prominent in debate, particularly on the questions of the Newfoundland fisheries and the navigation of the Mississippi. After his retirement from Congress he served for a brief term in the Virginia legislature. Consult Sanderson, 'Lives of the Signers' (Vol. IX, 1827).

LEE, Frederick Schiller, American physiologist: b. Canton, N. Y., 16 June 1859. He studied at Saint Lawrence University, at Johns Hopkins and at Leipzig, and in 1886–87 he was instructor in biology at Saint Lawrence University. He was instructor and associate professor of physiology and histology at Bryn Mawr College in 1887–91. In 1891 he was appointed demonstrator of physiology at Columbia University and he was subsequently adjunct professor and Dalton professor there, becoming Jessup lecturer in 1911. He was appointed to the United States Public Health Service in 1917. He edited the *American Journal of Physiology* in 1898–1914, and since 1900 has edited the *Columbia University Quarterly*. He has translated and edited a number of medical treatises, has contributed to the leading scientific journals and is author of 'Scientific Features in Modern Medicine' (1911).

LEE, Gerald Stanley, American author and lecturer: b. Brockton, Mass., 4 Oct. 1862. He was graduated from Middlebury College, Vermont, in 1885, and from Yale Divinity School in 1888. He was a Congregational minister for the ensuing nine years at Princeton, Minn., Sharon, Conn., and West Springfield, Mass. He was lecturer in the English department, Smith College, 1897, and has lectured on literature and the arts since 1898. He is editor of *Mount Tom, an All-Outdoors Magazine,* and author of numerous magazine articles and the following books: 'About an Old New England Church' (1893); 'The Shadow Christ' (1896); 'The Lost Art of Reading' (1902); 'The Child and the Book' (1902); 'The Voice of the Machines' (1906); 'Inspired Millionaires' (1908); 'Crowds — A Moving Picture of Democracy' (1913); 'Crowds, Jr.' (1914); 'We — A Confession of Faith for the American People' (1916); 'The Lonely Nation' (1917); 'The Air-Line to Liberty' (1918).

LEE, Guy Carleton, American publicist: b. 1862. He was graduated at Rutherford College, North Carolina, in 1889 and was admitted to the bar of North Carolina in 1894, Pennsylvania in 1895 and Maryland in 1897. In 1895 he was professor of English history and common law at Dickinson College; in 1896–98 he was scholar, honorary scholar and Fellow, and in 1898–1905 instructor in history at Johns Hopkins University. He lectured on comparative politics at George Washington University 1900–02, was literary editor of the Baltimore *Sun* 1901–08, and since 1900 has been editor-in-chief of the International Literary Syndicate. He has published 'Hincmar — An Introduction to the Study of the Church in the Ninth Century' (1898); 'Public Speaking' (1899); 'Historical Jurisprudence' (1900); 'Source Book of English History' (1900); 'True History of the War Between the States' (1903); 'Robert E. Lee: A Biography' (1905); 'The Heart of a Child' (1910); 'The Soul of a Woman' (1910); 'The Mind of Man' (1911); and was editor-in-chief of 'The World's Orators' (10 vols., 1900); 'The History of Woman' (10 vols., 1902–03); 'The History of North America' (20 vols., 1903–05). He has also contributed to reviews and journals on legal, historical, political and social subjects.

LEE, Harriet, sister of Sophia Lee (q.v.): b. London, 1756; d. Clifton, 1 Aug. 1851. In 1786 she published the 'Errors of Innocence,' a novel succeeded by several others now forgotten. In 1797–1805 appeared her 'Canterbury Tales,' 8 of the 10 tales of which were her own, the others being by her sister Sophia. They enjoyed a great popularity in the early part of the 19th century, and a new edition was published in New York in 1856–57. One of the most remarkable is the German tale, 'Kruitzner,' from which Lord Byron borrowed not merely the plot and the machinery down to the most trivial incidents, but in some instances the language, of his 'Werner.' She also wrote two dramas, the 'New Peerage' and the 'Three Strangers.'

LEE, Henry, American soldier: b. Leesylvania, Westmoreland County, Va., 29 Jan. 1756; d. Cumberland Island, Ga., 25 March 1818. He was graduated from the College of New Jersey in 1774; in 1775 became a captain in Col. Theodoric Bland's legion of Virginia cavalry, and in September 1777 joined Washington's army in Pennsylvania. Promoted major for services in battle (January 1778), he was given command of a partisan corps consisting of two troops of horse, and latter increased by a third troop and an infantry company. This corps, which was employed in the annoyance of the British march and camp, was known as «Lee's legion,» and its commander as «Light Horse Harry.» On 19 Aug. 1779 Lee surprised and captured the British post at Paulus Hook (q.v.), N. J. For this achievement, which is regarded as one of the most brilliant exploits of the Revolution, Congress voted him a gold medal. He was promoted lieutenant-colonel, and in the autumn of 1780 was sent to South Carolina to join Greene's army. He covered the American retreat through North Carolina (February 1781), and was involved in some smart skirmishes with Tarleton's dragoons. After Greene had crossed into Virginia, Lee remained in North Carolina to harass the enemy, and, although he could not surprise Tarleton, did defeat 400 loyalists under Colonel Pyle. He outfought Tarleton at Guilford Court House (15 March 1781), and with Marion, by cutting Rawdon's line of communication, compelled that officer to abandon Camden (10 May 1781). He took Augusta, Ga. (5 June 1781), and having rejoined Greene, fought with distinction at Eutaw Springs (8 Sept. 1781), and captured some of Rawdon's rear-guard in the British retreat. After having been present at Yorktown, he shortly resigned his commission. In 1785–88 he was a Virginia delegate to the Continental Congress; in 1788 was a member of the Virginia convention for the ratification of the Federal Constitution; in 1789–91 sat in the general assembly of the State and in 1792–95 was governor. In 1794 he was appointed by Washington to command the 15,000 troops sent to suppress the «Whiskey Insurrection» (q.v.) in western Pennsylvania. After service as a representative in the Sixth Congress (1799–1801), he withdrew from public life. In his 'Funeral Oration upon President Washington,' pronounced in 1799 before both Houses of Congress, occurs the since famous phrase, «First in war, first in peace, first in the hearts of his countrymen.» In 1801 he retired to private life, but received a commission in the War of 1812 as major-general. He was prevented from assuming duties of this office by a gun shot wound which he received while aiding his friend, Alexander Contee Hanson, whose house was attacked by a mob of political opponents. He wrote 'Memoirs of the War in the Southern Department of the United States' (1812), published in revision with a memoir by his son, R. E. Lee (q.v.) in 1869.

LEE, Hildegarde Langsdorf (MRS. GUY CARLETON LEE), American physician: b. Centerville, Pa., 26 March 1868. She was graduated at Dickinson College in 1888, and at the Woman's Medical College, Philadelphia, 1891. In 1912 she married Guy Carleton Lee (q.v.). She has practised her profession at Carlisle, Pa., since 1892; was on staffs of Harrisburg Insane Hospital, Norristown Insane Hospital, Tewksbury Almshouse. She is also assistant editor *Pennsylvania Medical Journal*, and secretary-treasurer National Society for Broader Education and many other societies; is especially interested in plans for financing charitable organizations, and is known as a lecturer on social and economic subjects and contributor of articles on sanitation, hygiene, etc.

LEE, James Prince, English bishop: b. London, 28 July 1804; d. Manchester, 24 Dec. 1869. He was graduated at Trinity College, Cambridge, 1828, ordained in 1830 and in 1830–38 he served as a master at Rugby under Dr. Thomas Arnold. He was elected head-master of King Edward's School at Birmingham in 1838 and numbered among his pupils E. W. Benson, archbishop of Canterbury, J. B. Lightfoot and B. F. Wescott, bishops of Durham. He became first bishop of the newly-created see of Manchester in 1848, and was especially notable for his work in church extension, consecrating 130 churches in the 21 years he served as bishop. He was active in the establishment of the Manchester Free Library, and bequeathed his own library to Owens College, Manchester.

LEE, Jennette Barbour Perry, American novelist: b. Bristol, Conn., 10 Nov. 1860. She was graduated from Smith College, Massachusetts, in 1886, was professor of English at Vassar 1890–93, and in the College for Women at Western Reserve University 1893–96, and in the year last named was married to Rev. G. S. Lee (q.v.). In 1901–04 she was instructor in English and in 1904–13 professor of English language and literature at Smith College. She has published 'Kate Wetherell' (1900); 'A Pillar of Salt' (1901); 'The Son of a Fiddler' (1902); 'Uncle William' (1906); 'The Ibsen Secret' (1907); 'Simeon Tetlow's Shadow' (1909); 'Happy Island' (1910); 'Mr. Achilles' (1912); 'Betty Harris' (1912); 'The Taste of Apples' (1913); 'The Woman in the Alcove' (1914); 'Aunt Jane' (1915); 'Unfinished Portraits' (1916); 'The Green Jacket' (1917), and numerous sketches and stories.

LEE, Jesse, American Methodist clergyman: b. Prince Edward County, Va., 1758; d. September 1816. He was admitted to the Conference as a preacher among the Methodists in 1783, and was chosen as a friend and traveling companion by Francis Asbury. His writings have been the basis of much of the history of early Methodism in America. In 1789 he traveled over New England and preached Methodism from Connecticut to Maine. He formed the first Methodist congregation in New England at Stratfield, Conn., 26 Sept. 1787. In 1792 he preached in Massachusetts, and gathered the first class at Boston 13 July 1792. He was chaplain to Congress during six successive terms. He is known in New England as «The Apostle of Methodism.» He wrote 'A History of Methodism in America' (1807). Consult Lee, L. M., 'Life and Times of Jesse Lee' (1848).

LEE, John Doyle, Mormon official: b. Kaskaskia, Ill., 1812; d. 23 March 1877. He became a Mormon in 1837, and after doing some missionary work began his official career. He was captain of militia, probate judge of Iron County and member of the Territorial legislature. In the Mountain Meadow Massacre he was indicted as one of the chief instigators and was condemned to death. Consult 'The Mormon Menace; being the Confession of John Doyle Lee, Danite, an Official Assertion of the Mormon Church under the Late Brigham Young' (with an introduction by Alfred Henry Lewis, New York 1905). See MOUNTAIN MEADOW MASSACRE.

LEE, Luther, American Methodist clergyman: b. Schoharie, N. Y., 30 Nov. 1800; d. Flint, Mich., 13 Dec. 1889. He entered the Genesee Conference in 1827, became an itinerant preacher and a temperance and anti-slavery lecturer, and was several times mobbed on account of his abolitionist sentiments. From 1843 to 1867 he was a member of the Wesleyan body, having as a Wesleyan clergyman been president in 1853 of Michigan Union College at Leoni and pastor of churches at Syracuse and elsewhere, but in 1867 returned to the Methodist Episcopal denomination. He was the author of 'Universalism Examined and Exposed' (1836); 'The Immortality of the Soul' (1850); 'Slavery Examined in the Light of the Bible' (1855); 'Elements of Theology' (1856); 'Natural Theology' (1866). His 'Autobiography' was published in New York (1882).

LEE, Nathaniel, English dramatic poet: b. Hatfield, about 1653; d. London, 1692. He was educated at Cambridge, turned his attention to the drama and in 1675 produced his tragedy of

'Nero,' and from that time to 1681 produced a tragedy yearly. From 1684 to 1688 he was insane and confined in Bethlehem Hospital, and after his discharge two more tragedies of his were produced. He is the author of 11 plays, all of which were favorably received; but his natural fire and pathos were buried in a torrent of words and clouded by a tendency to "furious fustian and turgid rant." In his play, 'The Rival Queens' (1677), occurs the oft-quoted line:

> "When Greeks joined Greeks then was the tug of War"

LEE, Richard Henry, American patriot: b. Stratford, Westmoreland County, Va., 20 Jan. 1732; d. Chantilly, Va., 19 June 1794. He was educated in England, but returned in 1752 to Virginia, where he soon became prominent in public affairs and was elected to the house of burgesses. In 1773 he became a member of the committee of correspondence to communicate with the other colonies, and in 1774 was a delegate from Virginia to the first Continental Congress. There he attracted attention by his eloquence and drafted the petition to the king. In the second Congress he prepared the address to the people of Great Britain. Both of these documents are remarkable state papers. On 7 June 1776 he moved "that these united colonies are and of right ought to be free and independent states; that they are absolved from all allegiance to the British Crown; and that all connection between them and the states of Great Britain is and ought to be totally dissolved." He was in the Virginia legislature in 1780–84, was elected president of Congress in 1784, in 1786 was again a member of the State legislature and in 1787 also sat in Congress. Upon the adoption of the Federal Constitution, to which he was opposed, he was elected one of the first two senators from Virginia and there remained, at first as an Anti-Federalist, until his resignation in 1792. He was one of the notable orators of his time. Consult Lee, R. H., (his grandson), 'Life and Correspondence of R. H. Lee' (1825). His 'Letters' have been edited by J. C. Ballagh (Vols. I, II, New York 1910, 1914).

LEE, Robert, Scottish clergyman: b. Tweedmouth, England, 11 Nov. 1804; d. Torquay, 14 March 1868. He was educated at Saint Andrew's University and in 1833 was elected minister of the Presbyterian chapel at Arbroath, Forfarshire. He was in charge of the parish of Campsie, Stirlingshire, in 1836–43, and from 1843 until his death was minister of the old Grayfriar's Church, Edinburgh. He also served as professor of biblical criticism and dean of the Chapel Royal at the University of Edinburgh from 1847. He was an earnest advocate of more graceful forms of worship within the Church of Scotland, working for the adornment of church edifices, written prayers, the sanction of suitable postures and the introduction of instrumental music. He was responsible for the installation of the first organ used in the national church, that at Grayfriars, in April 1864. In 1859 he was charged before the Presbytery of Edinburgh with unlawful innovations, but he ably vindicated his action and defeated his accusers. Other actions followed and the case of his distribution of printed prayer books among his congregation was in progress at the time of his death. Author of 'The Holy Bible. With the Marginal References revised and improved' (1854; 2d ed., 1855); 'Prayers for Public Worship, with Extracts from the Psalter and other parts of Scripture' (1857); 'The Reform of the Church in Worship, Government and Doctrine' (Part I, 1864), etc. Consult Story, 'Life of Robert Lee' (2 vols., 1870).

LEE, Robert Edward, American soldier: b. Stratford, Westmoreland County, Va., 19 Jan. 1807; d. Lexington, Va., 12 Oct. 1870. His father, Gen. Henry Lee (q.v.), popularly known in the War for Independence as "Light-Horse Harry," left his home at Alexandria (whither he had moved in 1811), when Robert was only six years of age, for a sojourn in the West Indies, on account of his health. After being away nearly five years, he returned, but the march of the fatal disease which had attacked him could not be resisted. When off the coast of Georgia, at his request he was put ashore on Cumberland Island and carried to the home of Mrs. Shaw, a daughter of Nathanael Greene, his old commander, where he died. Robert never saw his father after he left his home and was only 11 years old when he died. His mother was Anne Hill Carter.

Observant, respectful and dignified, the youth was reaching out for manhood over a route that might be used as a model for those who followed him. He obtained his early education in good private schools in Alexandria, Va., and being sedate and studious, stood high in the estimation of his teachers and was beloved by all his comrades. At 18 the inherited instincts of his nature became aroused and he resolved to be a soldier. A cadetship at the United States Military Academy at West Point was obtained for him by Gen. Andrew Jackson, and the natural bent of his mind was confirmed. To all duties he gave his closest attention; to all studies his profound thought; to all military drills, evolutions, tactics, strategy and commands, his perfect obedience. He became an officer in the cadet battalion at the proper time and was the adjutant of his class, when a first classman — a post of honor in a cadet's aspiration. After many who first entered the academy in his class had fallen by the wayside in the various examinations, semi-annually held, 46 still remained to receive graduating diplomas. In 1829 Lee graduated second in his class without having received a single demerit during his whole course of study, because he conscientiously discharged all the duties confided to him; convinced then as he said many years afterward, that "duty was the most sublime word in the English language." He was at once commissioned brevet second lieutenant and was assigned to the engineers corps, the "Scientific Corps of the Army" as it was called, and won high reputation in that important branch of the service. On 30 June 1831, two years after leaving West Point, he married Mary Randolph Custis, daughter of G. W. P. Custis, who was a grandson of Mrs. George Washington, and thus became proprietor of Arlington on the Potomac and other estates. Five years after, in 1836, he was promoted to first lieutenant and two years later, in 1838, was made captain. In 1834 he became assistant to the chief engineer of the army in Washington and in 1837 took charge of erecting works to protect Saint Louis from the erosion of the Mississippi. From 1841 to the outbreak of the Mexican War he was at Fort Hamilton in charge of the defenses of New York. During the Mexican War, the opportunity was presented for the first time to show the military mettle of the engineer officer, and Winfield Scott, when placed in command of the army to invade Mexico, constantly consulted with Lee, acted largely on his advice and mentioned him repeatedly in his official reports. Lee was responsible for the arrangement of the batteries used to reduce Vera Cruz. In that campaign he made a reputation superior to all officers of his grade. He surpassed them in personal daring, scientific counsels — a *coup d'œil* of the battle-field — and for felicitous execution of orders. In the reconnaissances before the victory of Contreras he especially distinguished himself, as was also the case at Chapultepec, where he was wounded. He was brevetted major at Cerro Gordo, 18 April 1847, lieutenant-colonel at Contreras and Churubusco and colonel at Chapultepec. His veteran commander said that his «success was largely due to the skill, valor and undaunted courage of Robert E. Lee,» and that «if opportunity offered, he would show himself the foremost captain of his time.»

At the close of the Mexican War his services as an engineer were again demanded by the government and he was made a member of the board of engineers of the United States army, being employed at Baltimore from 1849 to 1852 in the construction of forts for harbor defense; 1 Sept. 1852 he was made superintendent of the academy at West Point — a complimentary detail — and the school derived such benefit from his great ability and sagacious administration of its affairs that there was a general desire to retain him. Three years afterward, in 1855, the boundary lines of the United States having been extended, making it difficult to protect American citizens on the frontier, two new cavalry regiments were added to the three then in service and Lee was offered the position of lieutenant-colonel of the 2d cavalry by Jefferson Davis, the Secretary of War, and accepted, serving with his regiment at various posts in western Texas and giving very efficient service in protecting the settlers from the depredations of the Comanches and other Indians. Lee was at Arlington on a furlough to settle up the estate of his wife's father, Mr. Custis, when on 16 Oct. 1859 John Brown with a small force marched into Harper's Ferry to liberate slaves and inaugurate war between the whites and the blacks. No one then knew the limit of the aggressive action of Brown, but the War Department knew that an officer of balanced judgment, combined with experience and courage, should represent the government at that point. Lee was selected and he promptly responded to the summons to go to Harper's Ferry. His judicious plans to capture Brown were successful, and the latter's trial, conviction and execution followed. Lee then returned to Washington and in a short time was again on his way to resume his duties in Texas, having charge of the department of Texas until February 1861.

Though absorbed by the conscientious discharge of his duties, Lee's letters show that he had noticed the increasing chasm between the northern and southern sections of the republic, and that the citizens thereof were ranging themselves upon their respective sides. Hoping to the last that the diverging views could be brought together, Lee was at last face to face with the «irrepressible conflict» and could only consider on what side his sword, already famous, should be drawn. «We are between a state of anarchy and civil war. May God avert us from both. I must be patient and wait the end, for I can do nothing to hasten or retard it,» he said. «I cannot anticipate a greater calamity for the country than the dissolution of the Union,» he wrote in 1861. The pleading of the veteran Scott, who said that Lee's services to the Union would be worth to it 50,000 men, and the long friendship of his comrades must be resisted; but beyond all, the command of the army of the United States, offered him on 18 April by President Lincoln, had to be respectfully set aside. His reply to Francis Preston Blair, who had been designated to approach him on the subject, is the key to his action. «I declined the offer he made to me to take command of the army that was to be brought into the field, stating as candidly as I could, that though opposed to secession and deprecating war, I could take no part in an invasion of the Southern States.» His inability to accept forced a prompt resignation, which read:

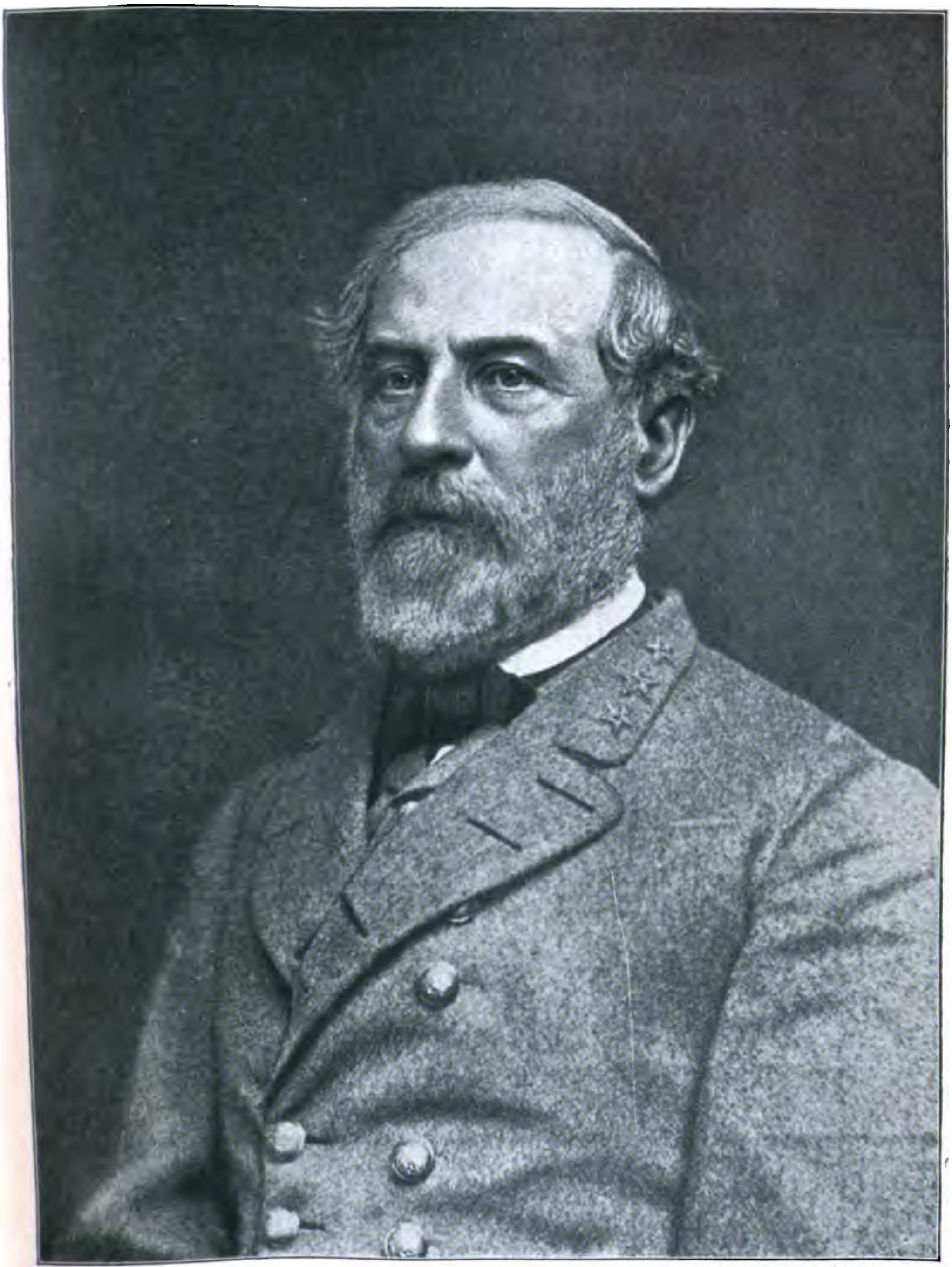
ARLINGTON, WASHINGTON CITY, P. O.,
April 20, 1861.

Honorable Simon Cameron,
Secretary of War.

SIR:—I have the honor to tender the resignation of my commission as colonel of the first regiment of cavalry.

Very respectfully your obedient servant,
R. E. LEE,
Colonel First Cavalry.

Having once decided the question he never faltered in his allegiance or doubted the correctness of his decision. He said to Gen. Wade Hampton in 1869, as they were discussing the war and its results: «I could have taken no other course without dishonor, and if it were all to be gone over again, I should act in precisely the same manner.» Going to Richmond at the request of the Virginia Convention, he was made major-general and commander-in-chief of the Virginia forces (23 April) and when Virginia joined the Confederacy he was commissioned in the Confederate service and made one of the five full generals. In July 1861 he endeavored from a distance to direct the Confederate attempts to hold what is now West Virginia and in August took personal charge of the difficult campaign, but the campaign failed through the fault of others and he was severely criticised by the newspapers. He was then put in charge of the sea-coast defenses in South Carolina, Georgia and Florida, and here his knowledge and practical experience in engineering came into play, for there is little doubt but that the heroic defense which that department afterward made was only possible through his skill and energy in placing it in proper condition. In March 1862 he was made military adviser to President Davis and occupied that position till the wounding of Gen. J. E. Johnston at Seven Pines. He quickly demonstrated his power of



Photograph by Geo. S. Cook, Richmond

GEN. ROBERT E. LEE

organization. Everything had to be created — armies organized and the various necessary departments constructed, and on 1 June he was placed in command of the Army of Northern Virginia. He at once determined to drive McClellan from the siege of Richmond. He summoned "Stonewall" Jackson to his aid, collected all the reinforcements he could and, after sending J. E. B. Stuart on a scouting circuit of the Union army, on 26 June opened the "Seven Days Battles," attacking McClellan's lines on the Chickahominy. Several battles were fought (Oak Grove, Mechanicsville, Gaines' Mill, Peach Orchard, Savage Station and Glendale, qq.v.), and, while repulsed in a bloody battle at Malvern Hill (1 July) where McClellan had made a last stand to save his army, Lee had prepared for a combined attack the next morning, but found that McClellan had retreated during the night under cover of his gunboats at Harrison's Landing, 30 miles below Richmond. He captured 52 pieces of artillery and quantities of stores of all kinds and left McClellan's army in a demoralized condition, and though he had not annihilated it, as he had designed and might have so done but for the failure of some of his subordinates, he had driven it away from Richmond, raised the siege and by a series of manœuvres brought it to pass that McClellan and Pope, who had taken command of the Army of Virginia, united forces near Washington. Here Lee completely routed Pope, the campaign culminating in the battles on the old field of Manassas on 28, 29 and 30 August and finally drove him to the fortifications in front of Washington (see Bull Run, Second Battle of). Then followed the Maryland campaign, in which Jackson captured Harper's Ferry with 11,000 prisoners and large quantities of arms and stores. On 14 Sept. 1862 a part of Lee's army under D. H. Hill was worsted in a battle at South Mountain (q.v.) or Boonsboro because McClellan had come into possession of Lee's orders. Accordingly Lee abandoned his intention of invading Pennsylvania, ordering an immediate retreat into Virginia on the 15th and deciding to fight McClellan on the heights and banks of the Antietam near Sharpsburg. At Sharpsburg (Antietam), 17 Sept. 1862, Lee repulsed every attack made by McClellan's well-equipped troops and advanced his own lines, only retreating across the Potomac when he learned that the Union army had received large reinforcements (see Antietam, Battle of). On 7 November Burnside superseded McClellan in command of the Union forces and crossing the Rappahannock at Fredericksburg, tried to take the Confederate army by surprise (13 December). Lee, however, had divined his purpose and, occupying a naturally strong position, not only repulsed his attack, but administered a crushing defeat, compelling him to recross the river, where his strong works and heavy artillery rendered him safe from a counter attack by Lee. (See Fredericksburg, Battle of). In February 1863 Hooker succeeded Burnside and was defeated by Lee at Chancellorsville (q.v.). In the Gettysburg campaign of 1863, Winchester was captured by Ewell, and at Gettysburg (q.v.) 1–3 July, Lee faced Meade, gained a decided victory the first day, gained some ground the second day, but was repulsed with heavy loss on the third day. He remained in line of battle all day the 4th of July and for several days at Hagerstown, but Meade did not attack him, and he later retreated into Virginia, in November and December 1863 compelling Meade to withdraw after the Mine Run campaign (q.v.), though the latter had 70,000 men to Lee's 50,000. In March 1864 Grant was made commander-in-chief of the Union army, "which was to crush Lee and capture Richmond." He had 120,000 well-equipped and provisioned troops, while Lee had not more than 62,000 men, badly armed, wretchedly equipped and poorly supplied with rations, clothing, ordnance stores and transportation. And yet he outgeneraled and defeated Grant in every battle in that campaign from the Wilderness to Petersburg, from the Rapidan to the lines in front of Richmond, compelling him to camp before Petersburg and remain practically idle for several months, or until March 1865. (See Wilderness; Todd's Tavern; Po River; Spottsylvania Court House; North Anna; Hawes' Shop; Pamunkey and Totopotomoy; Drewry's Bluff; Petersburg; Trevilian Station; Saint Mary's Church; Weldon and South Side Railroads; Jerusalem Plank Road; Deep Bottom; Globe Tavern; Ream's Station; Fort Harrison; Poplar Spring Church; Hatcher's Run; Fair Oaks). These great contests against enormous odds are a monument of the strategic and tactical ability of Lee as well as to the courage of his troops. His defense of Richmond and Petersburg alone was a marvelous example of defensive warfare. Now the supply of money was exhausted and the question of feeding the soldiers was daily becoming more troublesome. A discontinuance in the supply of arms and ammunition was imminent. His gallant army had been exposed in a violent campaign to overwhelming numbers and he no longer had "Stonewall" Jackson and J. E. B. Stuart by his side. During the remainder of the war Lee had to guard 40 miles of breastwork with a bare skirmish line and yet meet every move of the enemy, to supply his army, to recruit his thinned ranks from a country already stripped of its men, and to witness the starving out of his army — yet he met and overcame all these obstacles with a resourcefulness which was born of the highest order of military genius. (See Hatcher's Run; Fort Stedman). Having been made commander-in-chief of all the Confederate armies in February 1865, he determined to unite with Johnston and attack Sherman before Grant could reinforce him, but, on account of the poor condition of the roads and the lack of transportation facilities, Grant forestalled him with his 101,000 infantry, 14,700 cavalry, 9,000 field artillery, and 369 guns attacked Lee's army (46,000 infantry, 6,000 cavalry, 5,000 field artillery and 190 guns) at Dinwiddie Court House and White Oak Road (qq.v.) 30–31 March, and at Five Forks (q.v.) 1–2 April, inflicting a crushing defeat and causing him to retreat. Upon reaching Amelia Court House he found that his provisions had been sent in error to the capital, and so being unable to retreat or give battle with any degree of success, on 9 April, at Appomattox Court House, the Army of Northern Virginia surrendered. (See Farmville and Highbridge).

The number of men surrendered was about 27,000, but when the troops marched out to stack their arms hardly 8,000 were able to present themselves with muskets in their hands. When the time arrived for him to yield to the inevitable and surrender his splendid army, with whose courage and heroism the whole world was familiar, he was greater if possible than ever before. «When you return to your homes,» he said to his troops at Appomattox, «you will take with you the satisfaction that proceeds from the consciousness of duty faithfully performed, and I earnestly pray that our merciful God extend to you his blessing and protection.»

Lee was now a private citizen for the first time in 40 years. He refused lucrative offers from all sides and sections. The legislature of Virginia, desiring to testify its appreciation of his services and character, directed the treasurer of the State to subscribe 100 shares of stock at a par value of $200 in a company organized for the improvement of the navigation of the James River and vest the same in Lee. He would receive the gift only on condition that he would be permitted to use it for the «education of the poor, particularly the children of such as had fallen in defense of the country,» and he gave his stock to Liberty Hall Academy, in Rockbridge County, Va., afterward known as Washington College and now called Washington and Lee University (q.v.). Lee was offered the presidency of the college and at first declined, saying he was «an object of censure to a portion of the country and might draw upon the college a feeling of hostility.» «I think it is the duty of every citizen,» he further added, «in the present condition of the country to do all in his power to aid in the restoration of peace and harmony and in no way to oppose the policy of the State or general government directed to that object.» He finally accepted, however, saying that after what he had written if the board still thought his services would be advantageous to the college and country he would yield to their judgment, and in October 1865 was installed. He continued to refuse highly remunerative positions because he preferred to continue the educational work he had undertaken. At last, however, the labor and exposure of his campaigns and responsibilities attendant to his position as president of the college brought bodily distress. In the spring of 1870 he was persuaded to go south for his health, but the steady progress of the disease could not be checked and his life work rapidly drew to a close. On the evening of 28 Sept. 1870 he was stricken with apoplexy from which he never recovered; he lingered on for a fortnight, breathing his last on the morning of 12 Oct. 1870. Early in the war Lee's home at Arlington, Va., had been seized by Federal troops and in January 1864 was purchased by the national government at a tax sale for $26,800, the Arlington National Cemetery being established there later in the same year. In 1868 G. W. C. Lee, one of the heirs under the Custis will, brought suit to test the validity of the sale to the government, and though the suit was barred in the Supreme Court, Congress in 1883 appropriated $150,000 to acquire an undisputed title.

Lee had for 63 years lived and moved among a people who will cherish his memory through succeeding generations, as long as the sun, moon and stars endure. He was a most remarkable man whether soldier or citizen. From his earliest infancy to the hour of his death he was beloved by all classes — by all people, and the people of his native State of Virginia selected him as one of her two representatives whose statues should be placed in the rotunda of the capitol at Washington. Benjamin Hill, of Georgia, summed up Lee's character in splendid form when he said: «He was a foe without hate, a friend without treachery, a soldier without cruelty, and a victim without murmuring. He was a public officer without vices, a private citizen without wrong, a neighbor without reproach, a Christian without hypocrisy, and a man without guilt. He was Cæsar without his ambition, Frederick without his tyranny, Napoleon without his selfishness, and Washington without his reward. He was as obedient to authority as a servant and royal in authority as a king. He was as gentle as a woman in life, pure and modest as a virgin in thought, watchful as a Roman Vestal, submissive to law as Socrates, and grand in battle as Achilles.»

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FITZHUGH LEE,
Revised by IRVING E. RINES.

LEE, Samuel, English clergyman and Orientalist: b. Longnor, Shropshire, 14 May

1783; d. Barley, Hertfordshire, 16 Dec. 1852. He acquired Greek, Hebrew and a knowledge of Chaldee, Syriac, Samaritan, Persian and Hindustani without instruction and was graduated from Queen's College, Cambridge, in 1818. He was appointed professor of Arabic at Cambridge in 1819, held several parishes, was regius professor of Hebrew at Cambridge in 1831–48 and in 1838–52 he was rector of Barley. He was a linguist of rare attainments and was reputed to have mastered 18 languages. Author of 'Novum Testamentum Syriace' (1816); 'Vetus Testamentum Syriace' (1823); 'Grammar of the Hebrew Language' (1830; 6th ed., 1844); 'Hebrew, Chaldee and English Lexicon' (1840), and numerous scholarly translations.

LEE, Samuel Philips, American naval officer: b. Sully, Fairfax County, Va., 13 Feb. 1812; d. Silver Springs, near Washington, D. C., 5 June 1897. He entered the navy as midshipman in 1825 and was promoted passed midshipman in 1831. He reached the rank of commander in 1855, and served on the board of examiners in 1858–60. He was assigned to blockade duty off the coast of South Carolina on the outbreak of the Civil War. He was appointed acting rear-admiral in 1862 and placed in command of the North Atlantic blockading squadron and perfected a blockading system by which the Confederacy was completely isolated. In 1864 he received command of the Mississippi squadron and moved up the Cumberland to the support of Hooker, keeping communications open and gaining a vote of thanks from Congress. He was promoted commodore in 1866 and rear-admiral in 1870, receiving at that time command of the North Atlantic squadron. He was retired 13 Feb. 1873. Author of 'The Cruise of the Dolphin' (Reports of the United States Navy Department, 1854).

LEE, Sir Sidney (formerly SOLOMON LAZARUS), English author and editor: b. London, 5 Dec. 1859. He was educated at the city of London School and at Balliol College, Oxford, from which he was graduated in 1882. In 1883 he became assistant editor of the 'Dictionary of National Biography,' in 1890 joint editor with Sir Leslie Stephen, and on the retirement of the latter in 1891 was appointed editor-in-chief. Under his editorship appeared the last 37 volumes (Vols. XXVII–LXIII, 1891–1901), together with two supplements (6 vols.) and the 'Index and Epitome.' To this work he contributed 820 articles. His 'Memoir on King Edward VII,' contributed to the 'Second Supplement,' provoked a storm of controversy, his portrayal of that monarch not being regarded by many critics as sufficiently eulogistic. He was Clark lecturer in English literature at Trinity College, Cambridge, in 1901–02, Lowell Institute lecturer at Boston in 1903, and lecturer for the Common University Fund at Oxford in 1909. He was knighted in 1911, and in 1913 was appointed professor of English language and literature in the University of London. He has published 'Stratford-on-Avon from the Earliest Times to the Death of Shakespeare' (1885; new ed., 1906); 'Lord Herbert of Cherbury's Autobiography, with a Continuation of his Life' (1886; new ed., 1906); 'A Life of William Shakespeare' (1898; popular ed., 1900, 1907; rev. and rewritten, 1915); 'A Life of Queen Victoria' (1902; new ed., 1904); 'Shakespeare's First Folio Facsimile, with Introduction, and Census of Extant Copies' (1902); 'Elizabethan Sonnets' (1904); 'Great Englishmen of the 16th Century' (1904); 'Shakespeare's Poems and Pericles' (1905); 'Shakespeare and the Modern Stage' (1906); 'America and Elizabethan England,' in *Scribner's Magazine* (1907); 'The French Renaissance in England' (1910); 'Principles of Biography,' Cambridge Lecture (1911); 'Shakespeare and the Italian Renaissance,' British Academy Shakespeare Lecture (1915); 'The Life of William Shakespeare' (1916).

LEE, Sophia, English author: b. London, May 1750; d. Clifton, near Bristol, 13 March 1824. She was the eldest daughter of John Lee, an actor. She was the author of a comedy entitled 'The Chapter of Accidents,' brought out at Haymarket Theatre in 1780 with great success. The next year her father died and she removed with her sisters to Bath, where she devoted the profits of her play to the establishment of a young ladies' seminary over which she and her sister Harriett (q.v.) long presided. She wrote two or three novels and contributed 'The Young Lady's Tale' and 'The Clergyman's Tale' to the 'Canterbury Tales,' published by herself and her sister.

LEE, Stephen Dill, American soldier: b. Charleston, S. C., 22 Sept. 1833; d. Vicksburg, Miss., 28 May 1908. He was graduated from West Point in 1854; served on the frontiers of Texas, Kansas and Nebraska; was promoted to the rank of first lieutenant in 1856 and served in Florida in 1857. On the secession of South Carolina he resigned from the United States army and was made captain of South Carolina volunteers, and gradually rose from this rank to that of lieutenant-general. He was at Seven Pines, at the Seven Days' Battles around Richmond, in the campaign against Pope and at the second battle of Bull Run. He was placed in command of the forces at Vicksburg, but was succeeded by General Pemberton before the capture of the city by the Federals. After the war he settled at Columbus, Miss. He was elected to the State senate in 1870 and was a prominent member of the Constitutional Convention in 1890. In 1880 he was made president of the State Agricultural and Mechanical College at Starkeville, holding this position till 1899, when he became commissioner of the Vicksburg National Park. He was president of the United Confederate Veteran Association after 1904.

LEE, Thomas George, American professor of anatomy: b. Jacksonville, N. Y., 27 Nov. 1860. He was educated at the universities of Pennsylvania, Würzburg, Harvard and Munich, and in 1884–86 he was assistant professor of histology and embryology at the University of Pennsylvania. He was lecturer and director of the laboratory at Yale in 1886–91 and assistant professor of histology at Radcliffe in 1891–92. In 1892 he went to the University of Minnesota as professor of embryology and histology, became professor of anatomy and director of the Institute of Anatomy in 1909, and since 1913 he has been professor of comparative anatomy there. He is associate editor of the *Anatomical Record* and has written several monographs on the embryology of vertebrates.

LEE, Vernon, the *nom-de-plume* of the English writer, Violet Paget (q.v.).

LEE, William, English clergyman and inventor: b. probably at Calverton, Nottinghamshire; d. Paris, about 1610. He was educated at Cambridge University and while either curate or incumbent at Calverton he, in 1589, invented the stocking-frame. Failing to secure royal patents in England, owing to the aversion to supplant hand-labor by machinery, he removed to France upon the invitation of Henry IV, who promised the patronage withheld by Queen Elizabeth. He established his frames at Rouen and was highly successful in his undertaking until the assassination of Henry IV, and subsequent unsettled conditions caused the withdrawal of royal patronage. He died, disappointed and unremunerated, and his workmen returned to England where the foundation of the manufacture of hosiery by machinery was then laid.

LEE, William, American diplomatic representative: b. Stratford, Va., 1737; d. near Williamsburg, Va., 27 June 1795. He was a brother of Arthur Lee (q.v.), Francis Lightfoot Lee (q.v.) and Richard Henry Lee (q.v.). Prior to the Revolution he was active as a merchant in London; and there he was for a time agent of Virginia colony. In 1777 he became associated with Thomas Morris (q.v.) as superintendent of the commercial affairs of the United States at Nantes, France, and in 1778 was appointed commissioner to Prussia and Austria, but accomplished nothing. A treaty drawn up by him with Neufville, a merchant of Amsterdam, in the year 1778, and approved by the burgomaster of that city, became the avowed cause of the war declared by Great Britain against Holland. Consult Wharton, 'Revolutionary Diplomatic Correspondence of the United States' (1889).

LEE, William Little, American lawyer: b. Sandy Hill, N. Y., 25 Feb. 1821; d. Honolulu, 28 June 1857. He was educated at Norwich University, Vermont, and at the Harvard Law School, and engaged in the practice of law at Troy, N. Y. Threatened with tuberculosis, he in 1846 decided to remove to Oregon, making the journey by sea; but repairs on the vessel detained him at Honolulu and he undertook some important legal commissions from the Hawaiian government. He afterward accepted the appointment of chief justice and chancellor and remained in those offices until his death. He framed a new constitution with civil and criminal codes; was president of the commission governing the distribution of lands to the common people, a proceeding due to his good offices; and in 1855 he negotiated a reciprocity treaty with the United States. His death was due to a recurrence of his old trouble following overwork in the Hawaiian small-pox epidemic of 1853.

LEE, Mass., town, in Berkshire County, on the Housatonic River and on the New York, New Haven and Hartford Railroad, about 33 miles northwest of Holyoke and 10 miles south of Pittsfield. The town includes the villages of South and East Lee. Lee is situated in an agricultural region; but the country is traversed by the southern spurs of the Green Mountains, known as the "Berkshire Hills" in this region. The delightful climate and beautiful scenery make Lee and vicinity favorite summer resorts. The town was settled in 1760 and incorporated in 1777. A fine white marble found in the town is much used for building purposes. The principal manufactures are paper and dairy products. The government of the town is administered by a town meeting or by officials elected at the annual town meeting. Pop. about 4,106. Consult Hyde and Hyde, 'Centennial History of Lee.'

LEE, nautical term designating the side of a ship sheltered from the wind. The word comes from the Anglo-Saxon *hleo* and it is likewise found in other languages, the Icelandic *hle,* the Dutch *lij,* the Danish *læ.* A "lee shore" is one unprotected from the wind, as the wind blows straight upon it. To "get under the lee" is to take a position placing some object between one and the wind. "Leeway" is when a ship drifts away from her course before the wind. "Leeward" means the direction away from the wind. "Lee anchor" is the one not held taut by the swinging of the ship in the wind. A "lee-board" is one of two long, flat pieces of wood placed on the sides of a shallow boat and kept close-hauled except when the one on the lee side is let down to prevent the boat from drifting too rapidly to "leeward."

LEE-BOARD. See CENTRE-BOARD.

LEE FAMILY, The, a family of Virginia, some of whose members have been conspicuous in public affairs at almost every stage of American history. Among all the eminent names of the South there is none that outranks this in the number or prominence of those who represent it in the records of the nation. Sprung from a cavalier line of old and distinguished English stock, the Virginia Lees have continued in the New World that order of Old-World aristocracy — an aristocracy of character and culture, of honor and of public service — which has legitimated itself under the broadening conditions of democratic development, and to which, as well as to the plainer but not less masterful middle-class English element that elsewhere entered into the making of the republic, democracy in the American Commonwealth owes its most essential traits. That Richard Lee who, during the reign of Charles I, brought his large household to Virginia and himself became the first of this illustrious line in America, brought also to the Northern Neck in Northumberland County, where he settled, an English yeoman's sturdiness, raised and enlightened and nowise debilitated by the refinements of gentility. A stout partisan of the Stuart cause, he supported Sir William Berkeley (q.v.) in his resistance to Cromwell's policy, and through this attitude the colonists, threatened by the Protector's fleet, forced its commander into a treaty styling the colony an independent dominion. Lee is said to have joined successfully with Berkeley in having Charles II proclaimed king in Virginia nearly two years earlier than his final coronation in London. Richard Lee's son, Richard, and the second Richard's third son, Thomas, were leaders in the colony, Thomas dying just as his governor's commission was made out. By his wife, Hannah Ludwell, he had five sons, who became distinguished for public and patriotic acts. Of these, Richard Henry Lee (q.v.), by reason of the diversity and singular efficiency of his services, rendered for many years before the Revolution, during that struggle and for 10 years afterward, to Virginia and all the colonies and later States, stands among the pre-eminent figures of his day. The steps preliminary to the Declaration of Independence can never be recalled without remembrance of him as mover of the resolutions which led to its adoption in the Continental Congress. The address to the people of Great Britain, which he wrote, is perhaps surpassed in weight and loftiness of spirit by no American state paper. His brother, Francis Lightfoot Lee (q.v.), not only was one of the signers of the Declaration, but also made liberal sacrifices for the patriot cause, all the more to be remembered to his honor when it is considered that by temper and education he was fitted rather for the occupations of a student, and for social elegancies, than for the turmoil of politics and the tragedies of war. Arthur Lee (q.v.), youngest son of Thomas, was educated in two professions, medicine and law, and distinguished himself by public services both at home and abroad. As representative of the colonies in Europe during the Revolution, he displayed abilities as a man of learning, versatility and political sagacity, which he applied in ways highly useful to his country in critical times. William Lee (q.v.), another of the sons of Thomas, also represented the United States in Europe at that period, with less distinction than others of this family attained, but not without some exhibition of their unusual qualities. The fame of Henry Lee (q.v.), the “Light Horse Harry” of the Revolution, unique in several respects, is enduring by reason of his political and military services, while his name is endeared to the American people for his noble eulogy of Washington. As first cousin of Richard Henry Lee and of Arthur Lee, his rights are as valid as theirs in the name to which he adds a lustre in return for that it sheds on him. His son, Robert Edward Lee (q.v.), not only stands as a connector of the two great epochs of his country's history — the Revolutionary period and that of the Civil War — but in his life and deeds, he worthily perpetuated the fame of the great family whose name he bore, whose blood, whose spirit, whose traditions he inherited. His nephew, Fitzhugh Lee (q.v.), whose name may fittingly close this sketch, was one of those Americans who, in civil and in military life, proved themselves efficient factors in the final restoration of the Union.

LEE-HAMILTON, Eugene, English poet: b. London, 6 Jan. 1845; d. 9 Sept. 1907. He was educated at Oxford and entered the diplomatic service in 1869, resigning in 1875. He was for many years an invalid, obliged to maintain a recumbent posture continually and turning to his art for solace. In 1896 he recovered his health, and in the following year visited the United States and Canada. Among his published works are ‘Poems and Transcripts’ (1878); ‘The New Medusa’ (1882); ‘Imaginary Sonnets’ (1888); ‘The Fountain of Youth’ (1891); ‘Sonnets of the Wingless Hours’ (1894); ‘Forest Notes’ (1898); ‘The Lord of the Dark Red Star’ (1900); and ‘The Romance of the Fountain’ (1905). He is a half-brother of Violet Paget (q.v.), “Vernon Lee,” and married in 1898 the novelist, Annie E. Holdsworth (q.v.).

LEE-METFORD RIFLE, a military weapon formerly manufactured for the use of the United States navy and now displaced by the Springfield (q.v.). It was a gun discharging a steel-jacketed bullet with smokeless powder. The velocity of the bullet was 2,460 feet per second and the penetration at the regulation range of 15 feet was 62 pine boards each seven-eighths of an inch in thickness. The pressure on the gun when fired was 60,000 pounds to the square inch. The rifle could kill at over a mile.

LEECH, John, English illustrator: b. London, 29 Aug. 1817; d. there, 29 Oct. 1864. He studied at the Charterhouse School nine years, where Thackeray was his school-fellow; began the study of medicine at Saint Bartholomew's Hospital; but soon he gave up his medical studies and began making drawings. The first of his important works were the illustrations to the ‘Ingoldsby Legends.’ He joined the staff of *Punch* in 1841. In that field he worked with pre-eminent success, supplying weekly pictures of all sections of English life — scenes of field and forest, of the busy streets, of the rustic cottage and alehouse, and the elegant city dwelling and club; the huntsman, the swell, the injured paterfamilias; the fast young lady and her grave, portly mother; the housemaid and her follower, etc.— all thrown off with remarkable precision and showing a steady growth in artistic power. He was buried beside Thackeray in Kensal Green Cemetery. His designs for *Punch* have nearly all been published separately as ‘Pictures of Life and Character’ and as ‘Pencilings from Punch.’ He also executed the illustrations for ‘The Comic History of England,’ ‘The Comic History of Rome’ and various other books. Consult Brown, ‘John Leech’ (1882); Everitt, ‘English Caricaturists’ (1886); ‘Life,’ by Frith (1891).

LEECH LAKE, a body of water in Cass County, Minn., the largest of the lakes which constitute the headwaters of the Mississippi River. It is about 1,300 feet above the level of the sea; 24 miles long and 15 miles wide. The short stream, which is the direct outlet of the lake and flows into the Mississippi, is called Leech Lake River. The United States has built a dam at its outlet, which drains into the Mississippi. On the south and east shores is the Leech Lake Indian Reservation. The country round is well wooded and fish and game are plentiful.

LEECHBURG, Pa., borough in Armstrong County, 34 miles northeast of Pittsburgh, on the Pennsylvania Railroad. The first use of natural gas in iron making in western Pennsylvania was made here in 1874. There are cement, steel and iron works and rich coal mines. Pop. 3,624.

LEECHEE. See Litchi.

LEECHES, highly specialized *Annelida* constituting the order *Hirudinea* or *Discophora.* They are distinguished from most other annelids by the nearly complete obliteration of the cœlom or body-cavity, owing to the development of parenchymatous connective tissue, muscles, etc., the presence of an anterior or oral sucker and a posterior or subanal sucker, and by the absence of setæ, except in *Acanthobdella*. In all leeches which have been carefully studied there are exactly 34 segments or somites, each represented by a ganglion in the central nervous system, and being of smaller size and simpler structure toward the ends than in the middle of the body, where each is divided into from 2 to 12 rings, one of which, sometimes regarded as the first, sometimes as the middle ring, bears metameric, eye-like sense organs. Most leeches are temporary parasites, a few nearly permanent parasites; the rest are predatory hunters or scavengers, or they may change from one mode of life to another. They are marine, fresh-water or terrestrial. The first class is most abundant, both in individuals and species, in cold seas, the second is both temperate and tropical and the third is confined to warm regions. Four families are distinguished: the *Ichthyobdellidæ* or fish-leeches, the *Glossiphonidæ* or tortoise and snail leeches, the *Herpobdellidæ* or worm-leeches and the *Hirudinidæ* or jawed leeches. The first two families possess a long protrusible proboscis and are much more closely allied than the *Herpobdellidæ* and *Hirudinidæ*, which have no proboscis. The *Ichthyobdellidæ* are chiefly parasitic on fishes and, except a few fresh-water forms, are marine. Some of them, as *Branchellion*, are branchiate. The *Glossiphonidæ* are richly represented in the fresh-water lakes and streams of North America by a great variety of species, most of which attach themselves to tortoises, whose blood they suck, or else they devour water-snails and small worms. A few are parasitic on fishes. In all of them the oral sucker is small and the eyes in one to four pairs placed near the median line. The *Herpobdellidæ* contains slender, six or eight-eyed, predaceous leeches, which are extremely abundant in fresh-water ponds and feed on small leeches and worms. They have no toothed jaws and the digestive tract is simple and straight. The *Hirudinidæ* have 10 eyes, generally three-toothed jaws and a spacious sacculated digestive tract. Here belong the true blood-sucking leeches, the medicinal leech of Europe and our native *Macrobdella decora*, also formerly largely employed in this country for blood-letting. The only terrestrial leech of the United States belongs to this family. It inhabits garden soil, feeds on earthworms and is one of the largest leeches known. Consult Beddard, F. E., 'Earthworms and Leeches' (in 'Cambridge Natural History,' Vol. II, Cambridge 1901); id., 'Earthworms and their Allies' (New York 1912); Leuckart and Brandes, 'Parasiten des Menschen'; Moore, J., 'The Leeches of the United States National Museum' (in 'Proceedings' of the United States National Museum, Vol. XXI, Washington 1899); Verrill, A. E., 'Invertebrate Animals of Vineyard Sound' (ib. 1874); Whitman, *Quarterly Journal Microscopical Science* (1886); Moore, 'Bulletin Illinois State Laboratory of Natural History' (1901).

LEEDS, England, a municipal, parliamentary and county borough and large manufacturing city, in the West Riding of Yorkshire, on the river Aire, 185½ miles north of London. The river, which in passing through the city is spanned by eight bridges, is navigable from its mouth in the Humber, and connects with the Leeds and Liverpool Canal (127 miles long) which gives communication with the west. The town extends for about seven and one-half miles from east to west and about seven from north to south. From the extent of the manufactures the town is naturally smoky, and on the whole its appearance is not prepossessing, although much modern improvement has been effected. The most conspicuous building is the Roman-Corinthian town-hall, considered one of the finest municipal buildings in the kingdom. The greater portion of one wing is allotted to the Free Public Library, to which has been added the Fine Art Gallery. Other notable buildings are Leeds Infirmary, in the Gothic style; the new general post office, in the Renaissance style; the school-board offices, the Royal Exchange, the stock exchange, Leeds University (q.v.), the Leeds Institute of Science, Art and Literature; the Grand Theatre, the new Empire Theatre, the grammar school, the Coliseum (a public hall), etc. Among the places of worship are the parish church of Saint Peter's; Saint George's, with a tower and spire 160 feet high; Holy Trinity, a fine building in the Early English style; some of the Dissenting places of worship, and the Roman Catholic church of Saint Ann's. Other institutions are the Leeds Medical School (1894), Young Men's Christian Institution, a large training college for students for the Wesleyan ministry and a literary and philosophical society. There is an admirable central library with 24 branches. The grammar school dates from 1552. The charitable institutions of Leeds are numerous. Parks have been laid out by the corporation and recreation grounds, the chief being Roundhay Park (two miles from Leeds), 300 acres in extent and containing a lake of 33 acres. The fine ruins of Kirkstall Abbey (q.v.) (three miles from Leeds), a Cistercian foundation dating from 1152 with the adjacent grounds, presented to the town by Colonel North in 1889, form an attractive resort. Adal Church, nearby, dates from 1140. There are interesting Roman remains in the vicinity. The waterworks supply Leeds with water from the Washburn, a tributary of the Wharfe. The street car system, which is railless overhead trolley, is owned and operated by the municipality, as is electricity supply. An extension of the city boundaries took place in 1912, which brought in the Roundhay, Shadswell and Seacroft districts.

Leeds is and has been for generations the chief seat of the woolen manufacture of Yorkshire and has become the seat of other important industries. Chief of these is the wholesale clothing trade, in which several thousand hands are employed, many being also employed in the steel works, iron foundries, rolling-mills, tool and machine factories; in the boot and shoe factories and the leather trade, and in the cloth-cap trade, which is also becoming a great branch of industry. There are also locomotive works, tobacco manufactories, color-printing works, extensive chemical and glass works, important works for the making of drainage pipes, firebricks, ornamental terra-cotta and pottery ware, etc. One of the great sources of the wealth of Leeds is its abundant supplies of coal and iron. Nearly 100 collieries are worked in the district.

The history of Leeds extends over more than 1,200 years, the town being mentioned under the name of Loid or Loidis by the Venerable Bede as the capital of a small British kingdom about 616. Its first charter was obtained in 1208, and it was incorporated by Charles I in 1626. It was made a city in 1893, and its mayor was raised to the dignity of lord-mayor in 1897. The vicinity is crowded with villages, most of the inhabitants of which are employed in manufacturing for the Leeds market. Pop. about 453,170. Consult the publications of the Thoresby Society; Jackson's 'Guide to Leeds,' and A. Tait's volume on 'Some of the Public Institutions of Leeds' (London 1903).

LEEDS, University of. The Leeds School of Medicine, founded in 1831, and the Yorkshire College, established as a college of science in 1874, were united in 1884; from 1887–1903 the college formed part of Victoria University, Manchester, and from the latter year until it received its charter as the University of Leeds (25 April 1904) it was associated with Owens College of Victoria University. It has four faculties — arts, medicine, science and technology. There is an observatory, and the museums and laboratories are excellently equipped. The university owns a farm and dairy school at Garforth, and a new building has recently been opened for the agricultural department at the university. The university is supported by grants from the city of Leeds and the Yorkshire County councils, and it also receives liberal financial aid from the Clothworkers' Company of London which has in all contributed not less than £160,000, for buildings and technical equipment, and from the Skinners' Company of the same city. The students in 1913–14 numbered 1,262.

LEEDS MUSICAL FESTIVAL, a three-day, triennial musical event in England, inaugurated in 1858 as part of the ceremonies connected with the opening of the town-hall by Queen Victoria. Sterndale Bennett was the first conductor. While the festival was a success, giving £2,000 of its profits to the Leeds medical charities, it was not until 1874 that it was organized on a permanent basis. It produces new compositions, both choral and orchestral by native and foreign composers, and reached a high state of development under the direction of Sir Arthur Sullivan, who was its conductor in 1880–98, inclusive. Sir Michael Costa conducted the festival in 1874–77, and since 1901 Sir C. V. Standford has been conductor. Consult Bennett, J., and Spark, F. R., 'A History of the Leeds Festivals, 1858–89' (1892).

LEEK, England, market town in Staffordshire, 26 miles southeast of Manchester and 157 miles northeast of London, on the Churnet Valley branch of the North Staffordshire Railway. The church of Saint Edward the Confessor was built in 1180 but has been greatly changed through different restorations. There are ruins of the Cistercian Abbey, De la Croix, dating from 1214, and there are also remains of the Roman invasion. The town received its grant for a Wednesday market from King John. It has at the height of summer a double sunset, caused by the sun's sinking behind one hill to reappear and sink beyond another. The town has broad, regular streets, modern educational and municipal institutions and important manufactures of silks and of agricultural implements. Pop. 15,487.

LEEK, a mild onion-like plant (*Allium porrum*), native to the Mediterranean region and much cultivated for culinary purposes. For table use its stems are usually blanched by mounding earth about them as in blanching celery several weeks before they are needed for use. Leeks are used in soups and otherwise. They are the more tender and succulent the richer the soil. The flower stem is about two feet tall, and the flowers are disposed in large compact balls, supported on purple peduncles. The leek was well known to the ancient Egyptians, Greeks and Romans, and is a Welsh national emblem. Several species of the genus grow wild in the United States, furnishing the wild leeks, wild onion, field garlic, etc., of the country folk. When cows eat these plants their milk and butter is tainted in consequence. Compare GARLIC.

LEEMPOELS, lām′pools, **Jef (Joseph),** Belgian painter: b. Brussels, 15 May 1867. He studied at the Brussels Academy of Art under Portaels and Stallaert and specialized as a portrait and figure painter. He received the great state medal at Vienna in 1895 and was awarded gold medals at Saint Louis (1904), Antwerp, Paris and Buenos Aires. He is a chevalier of the Legion of Honor and of the Order of Leopold. His portraits include those of Belgian royalty and nobility, and he also spent a season in New York engaged in portrait work. His figure paintings are on the symbolic order and he is noted for his strong technique, fine coloring and careful finish. His 'Hymn to a Family' is a portrait group of himself and family, and his portrait of King Leopold hangs in the Senate House, Brussels. His figure paintings include 'Friendship'; 'Destiny and Humanity'; 'Angel or Demon'; 'Les Eplorès'; 'Dominique'; 'Men Going to Work,' etc.

LEER, lār, Prussia, city and riverport in the province of Hanover, 58 miles east of Gröningen, on the river Leda near its confluence with the Ems, and at a junction of railways to Bremen, Emden and Münster. The town is very old but its municipal privileges date only from 1823. The heathen place of sacrifice is near here. Leer furnishes steamboat connections with the North Sea health resorts, Borkum and Norderney, holds markets for livestock and has an extensive trade in foodstuffs, paper, hardware and Westphalian coal. Manufactures include textile industries, iron foundries, shipbuilding yards, and soap, cigar, vinegar and earthenware factories. Leer has broad, well-paved streets, a harbor improved in 1903, fine churches, a town-hall with a tower 165 feet high, and schools for the study of navigation and the classics. Pop. 12,690.

LEES, Charles Herbert, English physicist: b. Glodwick, Oldham, 28 July 1864. He was educated at Owens College, Manchester, and at Strassburg University. He was appointed assistant lecturer and demonstrator in physics at Owens College in 1891; became lecturer in physics at the University of Manchester in

1900, and was afterward professor of physics at the University of London. He has collaborated in the production of textbooks on practical physics and is author of papers on conduction of heat and electricity, and kindred subjects, published in the *Philosophical Magazine*, the *Philosophical Transactions of the Royal Society* and similar publications.

LEE'S MILL, Engagement at. Lee's Mill is a point on the Warwick River, in Virginia, near which occurred the first considerable collision of the Peninsula campaign. The Confederate forces under General Magruder occupied the line of the Warwick, and between Lee's Mill and Wynn's Mill Cobb's brigade threw up intrenchments and constructed redoubts for artillery. On 16 April 1862 Gen. W. F. Smith, with his division of Keyes' corps, was ordered by General McClellan to reconnoitre Cobb's position, stop his work and, if deemed judicious, drive Cobb from it. Brooks' Vermont brigade was thrown forward, and after an artillery fire of more than six hours, part of the time from 18 guns, four companies of the 3d Vermont crossed the stream below a dam and seized the rifle-pits of the 15th North Carolina, but were driven back with severe loss. The effort was renewed later in the day, when, under cover of a heavy artillery fire, which was sharply replied to, detachments of the 4th, 5th and 6th Vermont endeavored to cross the Warwick, but were driven back. The Union loss during the day was 156 killed and wounded, and 9 missing. The Confederate loss did not exceed 75 killed and wounded. The result confirmed McClellan in his conviction that the line of the Warwick could not be carried by direct assault, and he directed all his efforts to the siege of Yorktown (q.v.). Consult ‘Official Records’ (Vol. XI); Webb, A. S., ‘The Peninsula’ (New York 1881–1908); McClellan, J. B., ‘McClellan's Own Story’ (New York 1887); Allan, W., and Hotchkiss, J., ‘The Battlefields of Virginia’ (New York 1867).

LEESER, Isaac, American rabbi and journalist: b. Neuenkirchen, Prussia, 12 Dec. 1806; d. Philadelphia, 1 Feb. 1868. In his 18th year he removed to Richmond, Va., where he at first engaged in business. In 1829 he became Hazan or minister of Congregation Mikveh Israel of Philadelphia. His first work, ‘The Jews and the Mosaic Law,’ appeared in 1833, followed in 1837 by his sermons in two volumes. He edited in 1841 ‘Grace Aguilar's Spirit of Judaism,’ and began in 1843 his monthly magazine, *The Occident,* which he conducted until near the end of its 25th volume. In 1845 he published his Pentateuch in Hebrew and English, and in 1848 his edition of the ‘Daily Prayers,’ according to the German ritual. Retiring from the ministry in 1850, he issued an English translation of Schwarz's classic ‘Geography of Palestine,’ and an edition of the Hebrew Bible, with Jaquett. He began now an English translation of the Old Testament, completed in later years. In 1857 he was elected minister of the Beth El Emeth Synagogue, but continued his literary labors, editing ‘Dias Letters’ (1859); ‘The Inquisition and Judaism’ (1860); ‘Mrs. Hester Rothschild's Meditations and Prayers’ (1864); Grace Aguilar's ‘Jewish Faith and Spirit of Judaism’ (1864). In addition to his work as editor, translator, author and lecturer, he gave the impetus to nearly every Jewish charity in the city, while he suggested institutions that have since been established, so far-sighted was his vision. He was for decades the leader of the conservative party in American Israel and was aggressive and fearless in his opposition to the reform movement, whose progress, however, he could not check.

LEETE, Frederick De Land, American Methodist Episcopal bishop: b. Avon Springs, N. Y., 1 Oct. 1866. He was graduated at Syracuse University in 1889, and was ordained in the ministry in 1888. He held various pastorates, was general secretary of the Young Men's Christian Association at Utica in 1891–94, and in May 1912 he was elected bishop in charge of Georgia, South Carolina, Florida and Alabama. He is well known as a public speaker, and is author of ‘Everyday Evangelism’ (1909); ‘Christian Brotherhoods’ (1912); ‘The Church in the City’ (1915).

LEETE, William, English colonial governor of Connecticut: b. Dodington, Huntingdonshire, England, 1613; d. New Haven, Conn., 16 April 1683. He was destined for the profession of law, and after being called to the bar practised in the Bishop's Court at Cambridge, but joined the Puritans who were emigrating in great numbers to America, and reached the western continent in 1637. He made his home in the New Haven colony in 1639 and became a religious leader in Guilford, which he had helped to found. From 1658 to 1661 he was deputy governor of New Haven. From 1661 to 1665 he was governor, at which latter date the colony was united with Connecticut by royal charter. He was deputy governor of the colony of Connecticut from 1669 to 1676, when he was appointed governor, a position he held till his death.

LEETONIA, Ohio, village in Columbiana County, 58 miles north of Wheeling, W. Va., on the Youngstown and Ohio River, Pennsylvania and Erie railroads. It is situated in a coal-mining district and there is a supply of natural gas. There are manufactures of machinery and tools. Pop. 2,665.

LEEUWARDEN, lā'wär-dĕn, the Netherlands, Holland, capital city of the province of Friesland, 31 miles west of Gröningen, on the canal between Harlingen and Gröningen. The town grew around the courts of the Friesian stadtholders and is comparable to The Hague for its general attractiveness; possesses many handsome buildings and is one of the most important cities of second rank in the country. It was originally a walled city, but the old gates have been demolished, and the walls more or less obliterated. There is a town-hall built in 1715; a royal palace built for the Friesian stadtholders; the Kanselarji, dating from 1502; the unfinished church tower, Oldhove, built in 1529. Notable is the Friesian Museum, containing relics of several strata of civilizations from the stone to the modern age, gathered from the terpen, or artificial mounds, once very numerous in the province, richly illustrating the evolution of the race, and especially of the Teutonic migrations. The city has an extensive trade in grain, cattle, foodstuffs, wines and brandies, flax, chicory and woolens; and manufactures sewing-machines, musical instruments, gold and silver wares, cardboard and tobacco. There are shipbuilding yards and copper, iron and lead works. Its history dates back to 1149 and in 1190 it received its rating as a town. It had free access to the sea until about 1300 when the estuary on which it was built was silted up. It was important in the military history of the 15th and 16th centuries, and became a bishopric in 1559, but came under the Reformation in 1580. During our Revolutionary War, this city was the centre of interest in the American cause. On 26 Feb. 1782, after the pro-American excitement at Franeker (q.v.), the first vote to recognize the independence of the United States of America was taken in the legislature; the example of Friesland being quickly followed by the other six states of the Dutch Republic and then by the national body, the States-General, John Adams being received soon after as persona grata by the stadtholder, 19 April 1782. The Burgher's Club of Leeuwarden «in grateful recognition of the Acts of the Assemblies,» had a silver medal struck showing a man in ancient «Free Friesian» costume, between two female figures, holding back Great Britain and welcoming the United States, while a cherub from the skies confers upon the latter the hat of freedom. The States-General medal, commemorating recognition of the American by the Dutch Republic, represents the Dutch maiden, grasping over an altar the hand of the American «libera soror»; the reverse showing a steed free from all trammels, rushing to the mountains of freedom, with Latin mottoes meaning «Tyrants repulsed by valor,» and «under French auspices.» Another medal, rich in emblems, dates and Latin mottoes, struck 7 Oct. 1782, commemorates the Treaty of Commerce and Navigation made on that date between the two republics, Dutch and American. On 15 July 1909, in the presence of the queen's representative and an audience of notables, a bronze tablet «Memorial of Gratitude» erected by the De Witt Historical Society of Tompkins County, N. Y., was unveiled. Consult Griffis, 'The American in Holland' (1899). Pop. 37,897.

LEEUWENHOECK, lā'wĕn-hŭk, or **LEUWENHOEK, Antonius van,** Dutch anatomist and microscopist: b. Delft, 24 Oct. 1632; d. there, 26 Aug. 1723. He early gained a reputation for the high quality of the lenses he manufactured for the use of microscopists, demonstrating the superiority of single lenses of short focus to the double lenses hitherto in use. While not possessed of a scientific education his natural talent for investigation induced Leeuwenhoeck to make personal observations and his discoveries caused him to be termed the «father of scientific microscopy.» He was introduced to the Royal Society of London by De Graef in 1673; and in 1680 was elected a Fellow of the French Academy of Sciences, becoming corresponding member in 1697. His reputation for lenses, which he continued to manufacture during his life, was not surpassed in Europe, and a collection of 26 of the lenses bequeathed to the Royal Society, but subsequently lost, are stated to have been of double convex construction ranging from 40 to 160 diameters in magnifying power. His most important discovery was that of the capillary circulation of the blood, announced in 1690, and completing the theory of Harvey. His investigations definitely overthrew the theory of «spontaneous generation» supposed by even the learned at that time to be the origin of many insects and animals. His discovery of the spermatic animalcules, while made a few months later than that of Ludwig Hamm of Leyden, was nevertheless an independent investigation. He was the first to discover the mischievous effect of the *aphides* upon plant life, and he made careful observations on the structure of plants. Among his other discoveries were those of the red corpuscles of the blood, the fibrous structure of the crystalline lens, the nature of the brain, nerves, hair and epidermis. While his physiological speculations were at times wide of the truth they were not more so than those of the best physiologists of the day, and in the main display remarkable powers of observation coupled with sagacious deductions which anticipated many modern physiological discoveries. His method of scientific research set a high standard among biologists. Of his papers concerning his discoveries 112 were first published in the *Philosophical Transactions* of the Royal Society, and 26 appeared in the *Memoirs* of the Academy of Science. His collected works were published 'Sendbrieven, outledingen en outdekkingen oudervindigen en beschouwingen' (7 vols., 1685–1718); a Latin edition, 'Opera Omnia, sive Arcana Naturæ Ope Exactissimorum Microscopiorum Selecta' (7 vols., 1715–22; an abridged English edition translated by S. Hoole, 2 vols., 1798–1801).

LEEUWIN, lā'vĭn or lē'wĭn, **Cape,** the name of the point of land which is the southwestern extremity of Australia. It was named after the vessel *Leeuwin*, in which were the Dutch navigators who discovered in 1622 this part of the continent. The light from the lighthouse can be seen 20 miles away. The place is subject to severe storms.

LEEWARD ISLANDS. See FRENCH ESTABLISHMENTS IN OCEANIA.

LEEWAY, the deviation of a ship from her course caused by her lateral drift to leeward. Likewise, the angle caused by the line of a ship's course and that of her keel. When a strong wind is blowing the steersman makes a proportionate allowance between the headway and the drift to leeward. When steering in a smooth sea little or no leeway is made.

LEFÉBURE-WÉLY, lĕ-fā'bür-vā'lē, **Louis James Alfred,** French musician: b. Paris, 13 Nov. 1817; d. there, 21 Dec. 1869. In 1832, at the age of 15, he succeeded his father as organist of Saint-Roch, and in that year entered the Conservatoire. He was awarded second prizes in piano and organ in 1834 and first prizes in both in 1835. He afterward studied composition privately with Adolphe Adam, and the organ with Séjan. He retained his position as organist of Saint-Roch and engaged in teaching and composition. In 1847–58 he was organist at the Madeleine, and he succeeded Séjan at Saint Sulpice in 1863, He was noted for his improvisations, which, together with his compositions, were remarkable for their brilliant harmonies. He was elected to the Legion of Honor in 1850. He was especially famous as an organist and for his compositions for the organ. He was author of 50 études; three symphonies; three masses; an opera-comique, ‘Les recruteurs’ (1861); a cantata, ‘Apres la victoire’ (1863), etc.

LEFÉBVRE, le-fävr, **Charles,** French composer: b. Paris, 19 June 1843. He studied at the Conservatoire under Ambroise Thomas and in 1870 won the first prize with his cantata, ‘Le jugement de Dieu.’ He was afterward a professor at the Conservatoire and engaged in composition. He was author of several symphonies, sonatas, much instrumental music and ‘Judith’ (1879); ‘Melka’ (1883); ‘Zaire’ (1887); ‘Eloa’ (1889); ‘La messe du fantôme’ (1899); ‘Toggemburg’ (1906), etc.

LEFEBVRE, Jules, French painter: b. Tournan, Seine-et-Marne, 10 March 1836; d. Paris, 24 Feb. 1912. He was apprenticed to the trade of his father who was a baker, but through his mother's interest he was sent to Paris and became the pupil of Léon Coignet. His ‘Death of Priam,’ exhibited in the Salon (1851), won for him the Grand Prix de Rome, since which he gained many medals and honors. His ‘Femme Couchée’ in the Salon of 1868, a nude of singular freshness and power, established his reputation as an artist of the first rank, and the votes of the judges were divided equally between this picture and a painting of Corot's for the medal of honor, which was, however, bestowed on Brion. Among his best-known canvases are ‘Grasshopper’ (1872) in the Saint Louis Museum; ‘Mignon’ and ‘Graziella’ (1878) in the Metropolitan Museum, New York; ‘Diana Surprised’ (1879); ‘Lady Godiva,’ a painting popularized by many reproductions; ‘Psyche’ (1883). ‘La Vérité’ in the Salon of 1870 attracted wide attention, and in recognition of its merits the painter was decorated with the cross of the Legion of Honor. ‘Truth’ is represented as holding aloft to the world a shining mirror. The action is impressive, the lines and proportion of the figure admirable, although the coloring is a little cold. As a painter of ideal heads Lefebvre has become widely popular. His ‘Vittoria Colonna’ is one of the most effective of these. ‘La Liseuse’ (1889); ‘La Poésie Antique,’ ‘Laure’ and ‘Violetta,’ all exhibit the classic beauty, the repose and exquisite refinement of the ideal school while ‘Clemence Isaure’ is a study which is very human and life-like.

Lefebvre was one of the first of French painters, and his influence was great in the Julien School where he was one of the instructors. Among the romanticists, classicists, realists and impressionists, he stood in the same class as Hector Leroux, Baudry, Bougereau and Puvis de Chavannes, as an advanced idealist. Yet in opposition to such artists as Courbet, Manet and Bonnat, he was immensely popular, being in his love of ideal beauty and his refined technique “French of the French.”

LEFEBVRE, or **LE FEVRE, Nicolas** or **Nicasius,** chemist, probably a native of France: 1847–58 he was organist at the Madeline, and cated at the Protestant Academy at Sedan, acquired a knowledge of chemistry and became his majesty's apothecary and distiller. In 1660 appeared his ‘Traité de la Chemie Théorique et Pratique,’ which went through several editions, and was translated into German. In 1660 he was invited to London by Charles II to take the post of royal professor and apothecary in ordinary to the household. He was also elected to the Royal Society, which had just been founded. In 1664 appeared a translation into English of his ‘Traité’ entitled ‘A Compleat Body of Chymistry.’ The whole work is very well done, the author shows thorough familiarity with his subject, and his descriptions of apparatus, of substances and of preparations are clear and systematic. His work served as a model for those of succeeding chemists.

LEFEBVRE, Pierre François Joseph, Duke of Danzig, marshal of France: b. Rouffach, Alsace, 20 Oct. 1755; d. Paris, 14 Sept. 1820. At the outbreak of the Revolution he was a sergeant in the Guards. He espoused the cause of the revolutionists, rose to the rank of officer and was noted for his courage and humanity in the street fighting in Paris. He was promoted general of division in 1793. He served at Fleurs, Altenkirchen and in other actions of the Revolutionary campaigns, and in 1799 he was wounded at Stokach. He returned to France and aided Napoleon in the *coup d'état* of 18 Brumaire, and became one of the first marshals of the First Empire. He was at Jena, received his ducal title for his services at the siege of Danzig in 1806–07, served in Spain in 1808–09, and commanded the Bavarian forces at Abensberg, Rohr and Eckmühl. He was in command of the Imperial Guard in the Russian campaign and fought through Napoleon's last campaign against the Allies. He gave allegiance to Louis XVIII and was made a peer, but joined Napoleon in the Hundred Days and was not permitted to return to his seat in the Upper Chamber until 1819. He was one of the ablest of Napoleon's subordinate commanders, fearless, unassuming, trustworthy and loyal. His wife, nicknamed by the court, “Madame Sans Gêne” (q.v.), was, like himself, a child of the people and suffered much criticism, but retained his unquestioning loyalty.

LEFEBVRE-DESNOUETTES, lĕ-fĕv'r', dā'-noo'ĕt', **Charles,** Count, French cavalry general: b. Paris, 14 Sept. 1773; d. at sea, 22 April 1822. He volunteered in the Revolutionary army in 1792 and in 1798 had risen to the rank of captain, and was appointed aide-de-camp to Napoleon. He won promotion at both Marengo and Austerlitz, served in the Prussian campaign of 1806–07, and in 1808 became general of division and was created a count. He participated in the Spanish campaign and was taken prisoner by the English late in 1808. He escaped after two years and joined Napoleon's invasion of Russia. He took part in the Austrian and Prussian campaigns, served again under Napoleon in the Hundred Days and was wounded at Waterloo. He was condemned to death for his allegiance to Napoleon but made his escape to the United States. Eventually he obtained permission to return to France, but was lost at sea off the coast of Ireland when the *Albion* went down with all on board.

LEFEVRE, FAVRE, fä'vr', or **FABER**, fä'bar, **Pierre**, Jesuit priest: b. Villaret (now Villard), Savoy, 13 April 1506; d. Barcelona, 1 Aug. 1546. He studied at the College of Sainte-Barbe, Paris, and became the tutor of Ignatius Loyola. He was ordained in 1534 and on 15 August of that year he was one of the six original associates of Loyola in the foundation of the Order of the Jesuits. In 1537 he was professor of theology in the Collegio di Sapienza in Rome, and in 1538 he was sent to Parma and Piacenza where he labored for a revival of Christian piety. He was sent to Germany in 1540 to uphold Catholicism at the Diet of Worms, and he was called to that of Ratisbon in 1541. He then worked for a time in Spain, but returned to Germany in 1543 and established the Jesuit College at Cologne. In 1544 he was again sent to Spain where he founded Jesuit colleges at Coimbra, Madrid, Valencia and Valladolid He was selected to attend the Council of Trent in 1546, but died on the way. He was revered next to Loyola in the original order of the Jesuits. He was beatified 5 Sept. 1872 and his feast day is 8 August.

LEFFERTS, Marshall, American engineer: b. Bedford, Long Island, 1821; d. 1876. After receiving a common school education he took up various occupations, finally settling down in the profession of electrical engineer, which he pursued from 1849 to 1860. He patented an automatic system of telegraphic transmission. During that time he was in the employ of the American Telegraph Company, and consulting engineer to the Atlantic Cable Company. He made many improvements in inventions in the department of electrical transmission while in the service of these companies. During the war he commanded the 7th regiment. In 1867 he became connected with the news department of the Western Union Telegraph Company; two years later, president of the Gold and Stock Telegraph Company, and 1871 he took control of the commercial news department, which had been purchased by that company.

LEFFMANN, Henry, American chemist: b. Philadelphia, 9 Sept. 1847. He was graduated from Jefferson Medical College in 1869 and from the Pennsylvania College of Dental Surgery in 1884. He was elected assistant professor of chemistry at the Philadelphia Central High School and served from 1876 to 1880. He was port physician 1884–87, and 1891–92, and in 1888 was appointed but not confirmed, coiner United States Mint, political reasons interfering. After 1888 he was professor of chemistry at the Women's Medical College of Pennsylvania and professor of chemistry at the Wagner Free Institute of Science. Among his works are 'First Steps in Chemical Principles'; 'Compend of Organic Chemistry'; 'Compend of Chemistry'; 'Analysis of Milk and Water Products'; 'Sanitary Relations of Coal Tar Products' (from the German); 'Structural Formulæ for the Use of Students'; 'Analysis of Water'; 'Select Methods in Food Analysis' (2d ed., 1905); 'About Dickens' (1908); 'States-Rights Fetish' (1913). He edited Reese's 'Medical Jurisprudence and Toxicology' (4th and 5th eds.), and 'Allen's Commercial Organic Analysis' (Vols. I and II, 3d ed.).

LEFORT, lĕ-fôr', **François Jacques**, Russian admiral and statesman: b. Geneva, 1653 or 1656; d. Moscow, 2/12 March 1699. He was of Scottish descent, was educated at Geneva, and after service with the French and Dutch navies he joined the Russian army in 1675. He served in the wars against the Turks and Tatars and afterward became a sort of military monitor to the future Peter the Great. He was a close supporter and adviser of Peter in the struggle against his sister, Sophie, for the rulership in 1677–79 and gained the undying gratitude of the monarch. He reorganized the army with the assistance of Patrick Gordon, materially aided the realization of Peter's project of creating a navy, and was largely instrumental in introducing Western ideals in the court of Russia. He became grand admiral and generalissimo in 1694, and shared in the naval triumph in which Peter wrested Azof from the Turks in 1695–96. He was chief of the embassy in the expedition in which Peter the Great traveled incognito through Europe in 1697–98. Consult Bassville, 'Précis histoire la vie de François Lefort' (1784); Posselt, 'Der General und Admiral F. Lefort' (2 vols., 1866).

LEFRANC, lĕ-frän', **Abel Jules Maurice**, French historian: b. Elincourt-Sainte-Marguerite, Oise, 27 July 1863. He was educated at Paris and at the universities of Leipzig and Berlin. He was secretary, and later professor, of the College of France, was exchange professor at the University of Chicago in 1913 and was thrice a laureate of the French Academy. He was a collaborator on the 'Grande Encyclopédie' and attained general recognition as an authority on the literature of the 16th century. Author of 'Histoire de la ville de Moyon et de ses institutions jusqu' à la fin du XIIIe siècle' (1887); 'Histoire du Collège de France depuis ses origines jusqu' à la fin du premier Empire' (1893); 'Leçons sur Moliere et sur le roman français au XVIIe siècle' (1904–09); 'Défensede Pascal: Pascal est-il un faussaire?' (1906); 'Etudes sur Maurice Guérin et sur ses œuvres inédites' (1908); 'Les œuvres de François Rabelais' (1912–13); 'Grands ecrivains français de la renaissance' (1914); 'Œuvres inédits de André Chenier' (1914), etc.

LEFUEL, lĕ-fwĕl', **Hector Martin**, French architect: b. Versailles, 14 Nov. 1810; d. Paris, 1 Jan. 1881. He studied under his father and Huyot, and at the Ecole des Beaux-Arts, and in 1839 won the Prix de Rome. He designed in 1848 a mantel for the Palais de Florence which won great admiration, and in 1854 he succeeded Visconti in the direction of the work at the Louvre and at the Tuileries. He built the temporary palace for the Exposition des Beaux-Arts in 1855, and the façades of the Grand Galerie and the Rue de Rivoli were his work. He remodeled the pavilions Marsan and Deflore, and built the national porcelain works at Sèvres. He was a professor at the Ecole des Beaux-Arts, and in 1855 he was elected to the Institute.

LEG (a word of Scandinavian origin, Icelandic *leggr*, Danish *læg*, Swedish *läg*; the Anglo-Saxon word was *scanca* or *sceanca*, from which is derived the English word "shank"), one of the two lower limbs of man, and any one of the limbs of an animal, used in supporting and moving the body, in standing, walking, running, climbing or swimming. The sense of the word is occasionally restricted to the designation of that portion of the body between the knee and the ankle, but more generally it is used in describing the entire lower limb.

LEGACY, a gift of a chattel, money, or other personal property made through the will of a person deceased. Such bequests are either specific or general; a specific legacy as the name indicates is confined to the gift of a specific article, as a piece of plate, a painting, etc.; a general legacy is one which is paid out of the general assets of the estate. If the subject of the specific legacy fail, that is, if it goes out of the possession of the testator, the legacy becomes null, whereas a general legacy, which of its very nature is not to be paid out of any particular property or possession, does not lapse provided the general assets of the estate are sufficient to cover it. When the assets are insufficient, debts being first paid off, specific legacies take precedence over general, the latter being then reduced pro rata. A demonstrative legacy is a term given to a bequest which to some extent partakes of the character of the two preceding forms of bequest. It is one in which the testator orders to be given the legatee out of specific property or funds. Such is a bequest of a number of shares of stock out of a large number. In the case where the legatee dies before the testator the legacy lapses and is included in the share of the residuary legatee, or in case such a legatee is not named, passes to the testator's next of kin. Legacies may be satisfied by the testator previous to his death, in which case they are said to lapse by ademption. Legacies to a married woman are subject to the law governing the property of this class of persons, and legacies to a minor are payable to the guardian who holds such in trust for his ward. The testator's powers are in some States limited by statute. For these and for rules as to the interpretation of clauses giving bequests, the provisions in regard to illegitimate children, etc. (see WILL). Consult the references there appended.

LEGAL EDUCATION. Instruction in law schools is given by lectures, by recitations from textbooks and by discussion and explanation of selected cases. Each of these systems has its advocates. In a majority of the schools instruction is given mainly by lectures. Next in popularity comes the method of recitations on lessons previously assigned. There are only a few schools that depend mainly on the discussion and explanation of selected cases. See COUNSELLOR AT LAW, EDUCATION, PROFESSIONAL.

LEGAL HUNDRED, The, the governing conference of the Wesleyan Methodist Church established by John Wesley in 1784 in order to give to his Church organization a legal standing before the civil authorities. The powers of the body are defined in a paper called "the Deed of Declaration," its purpose being to secure the property and safeguard the unity of the Church. A hundred members were named from the General Conference, of which all ministers in the Church were members; vacancies are filled by election, thus rendering the body perpetual. The Conference meets once a year, its sessions never less than five days, nor longer than three weeks, and controls all Church procedure whether of denominational or business nature.

LEGAL PROCEEDINGS, all proceedings, whether civil or criminal, provided for by law and brought or instituted in a court of law, or legal tribunal, for the purpose of establishing or acquiring a right, or enforcing justice or a remedy. The term covers all the processes of a suit from its initiation to the filing of records. A secondary meaning of the term makes it distinguish between cases tried in common-law courts and those of ecclesiastical courts or courts of admiralty, chancery or equity.

LEGAL REPRESENTATIVE, or **PERSONAL REPRESENTATIVE,** one who personally represents another and succeeds to his rights and place, as the executors or administrators of a will or estate of a deceased person; the heirs of a deceased person either through relationship or bequest, and, in the case of a living person, a representative in cases of bankruptcy or insolvency, as an assignee or receiver; or a guardian, partner, an assignee of a mortgage or a grantee of land. The term originally designated only the executors or administrators of the estate of a decedent. The approval of the court is necessary to the confirmation of any such appointment.

LEGAL TENDER, in its widest sense, an offer to perform a contract according to specified conditions. It also designates the coin and paper money which a creditor may be compelled to accept in payment of debts. Generally speaking, all kinds of United States money are legal tenders in ordinary transactions, either with or without limit as to amount. Specifically, gold coins are a legal tender for any amount; gold and silver certificates are not legal tenders; silver dollars, United States notes and the few United States treasury notes of 1890 still outstanding are unlimited tenders unless otherwise contracted; subsidiary silver coin are legal tenders for all dues to the amount of $10, and minor coin for all dues to the amount of 25 cents. National bank notes are not really legal tenders, but in ordinary business they pass as such. They are receivable at par in payment of dues to the United States, except duties on imports and for payments by the United States, except interest on the public debt or redemption of the national currency. Certificates of deposit payable to order are issued to national banks for United States notes; they bear no interest, and are chiefly used in the settlement of clearing-house balances and in the reserves of the banks. State banks are governed by varying local laws, and their circulation is almost wholly within the several States. Consult Breckenridge, S. P., 'Legal Tender' (Chicago 1903); Hepburn, A. B., 'History of Coinage and Currency in the United States' (New York 1903); Hunt, A. R., 'Treatise on the Law of Tender' (Saint Paul, Minn., 1903); Laughlin, J. L., 'Economic Effects of Legal Tender,' in *Yale Review* (Vol. X, New Haven 1902); Smith, J. C., 'Legal Tender: Essays' (London 1910), and United States Revised Statutes, §§ 3584–3590, as amended.

LEGAL-TENDER CASES, in American finance, a series of cases before the United States Supreme Court, involving the question whether certain acts of Congress declaring United States notes a legal tender in payment of all debts, public and private, were constitutional. The cases were first argued in December 1867 and decided in November 1869, by a divided court. Five members of the court decided in the affirmative and three dissented. In 1871 after a reorganization of the Supreme Court, the cases were again brought up for argument. Again the court divided, five judges upholding the constitutionality of the act and four dissenting. All the judges agreed that Congress had full power to direct issues of paper money. In 1878 Congress decreed that legal tender notes which had been redeemed or received in the Treasury from any source should be reissued and kept in circulation. This latter act was assailed in the courts and the Supreme Court decided, with but one dissenting voice, that Congress had full power to make United States notes a legal tender in the payment of private debts in times of peace as well as in times of war. This decision closed all judicial action upon the subject. Consult Thayer, 'Legal Tender' in *Harvard Law Review* (1887); Legal Tender Cases (110 U. S. 421, 1884); Bancroft, George, 'A Plea for the Constitution' (New York 1886); Miller, 'Lectures on the Constitution of the United States' (ib. 1891).

LEGAL TERMS. The following is a list of the most important legal terms commonly employed in the United States and Canada. As it would be impossible to give anything like a complete list of such terms within any reasonably brief space — there being, in number, several thousand of them, — care has been taken to select only those which are most frequently used, and, in each case, as far as possible, to specify in what particular branch of law they are applied — whether in civil law, criminal law, pleadings or elsewhere:

Abalienation.— In civil law, the act of transferring a title in real or personal property from one person to another.

Abandonment.— (a) The act of voluntarily leaving a person to whom one is bound by ties of obligation, as husband, wife, etc.; (b) the relinquishment of one's rights in a possession or claim.

Abator.— (a) One who, without legal right, enters a freehold upon the death of its possessor, and before the heir or devisee; (b) a person who removes a nuisance.

Abetment.— In criminal law, the act of encouraging, counselling or inciting a felony.

Abeyance.— A state of uncertainty or of expectation.

Abjudication.— In civil law, the act of divesting a debtor of his real estate for the benefit of his creditors by means of judicial decree.

Abjuration.— The negative part of the oath of allegiance by the taking of which foreigners desiring to become citizens of the United States solemnly abjure their allegiance to the former sovereign.

Able.— In civil law, having the necessary qualifications; fit.

Abolition.— A suppression of proceedings, or permission to stay further prosecution.

Abrogation.— A term denoting the annulment of a law by the act of legislature or by usage.

Absentee.— One who is not within the jurisdiction of a particular court.

Absolute Estate.— An estate the right in which has been determined so unconditionally that the owner is deemed qualified to take immediate and unlimited possession.

Absolution. — In civil law, a formal sentence or decree declaring a person to be innocent of the crime with which he has been charged.

Absque hoc.— A term used in law in the denial of some matter of fact that has been alleged and is repeated.

Absque tali causa.— A term used in law to denote "without such cause."

Abs. re.— An abbreviation of the Latin phase "absente reo," used in law to indicate the absence of the defendant.

Abuse of Distress.— Such use of an animal or chattel distrained that the distrainer lays himself liable to prosecution for misappropriation.

Abuse of Powers.— Used (a) in civil law to denote the act of resorting to intentional irregularity in order to gain a legal advantage over one's opponent; (b) in criminal law to denote a use of legal processes for illegal purposes, as when a criminal complaint is made merely for the purpose of coercing the payment of a debt, or when valuable property is sold on execution to satisfy a very small debt.

Acceptilation.— In civil law, a release made by a creditor to a debtor without consideration and when the debt has not been paid.

Accomplice.— In criminal law, any participator in an offense, either before or after its commission.

Accrue.— In civil and criminal law, to become an enforceable right, as the statute of limitation, which accrues by lapse of time.

Accumulative Judgment.— A second judgment, which does not begin to exercise its effect until after the first judgment has expired.

Acquiescence.— (a) Used in Canadian law as a synonym for "free consent"; (b) a term used to denote any neglect to take legal proceedings that might naturally imply consent to the matter in hand.

Act in pais.— A term denoting an official act that has been performed out of court and has not been recorded.

Acts of Court.— See Law, *Legal Acts.*

Acuerdo.— A formal decision or decree of a qualified court.

Ac etiam.— A term used to denote the introduction to the statement of the real cause of action in a case where it was necessary to allege a fictitious cause of action.

Address.— In equity pleading, the technical introduction in a bill of the court in which a remedy has been sought.

Ademption.— The annulment of a grant or the lapse of a legacy by the testator, either by satisfying it or by manifesting an intention to revoke it.

Adjudication.— (a) The formal judgment of a court; (b) a decree in which the court declares an ascertained fact to be such, as in cases of bankruptcy.

Adjudication, Former.— A prior decision in a case between the same parties employed to bar any subsequent litigation covering the same or similar points in dispute.

Adjunction.— The act of affixing one person's property to that of another, as when one erects a building upon another's land, etc.

Admeasurement.— A term used to denote the act of ascertaining and laying off the portion due, as in cases of the settlement of an estate, the adjustment of damages, or of dower right. Sometimes known as admensuration.

Adminicle.— Synonymous for corroboratory evidence.

Admittance.— In civil law, the act of giving possession of a copyhold estate.

Adpromissor.— Synonymous for security, or bail.

Ad quod damnum.— (a) A term used to designate a writ issued commanding an inquiry as to the damage liable to result from the opening of a highway, or the institution of other public improvement; (b) the order under which the compensation for damage is paid when private property has been seized for public uses.

Advowson.— The right of presentation to a vacant benefice (q. v.).

Affeerment.— A term used to denote the assessment of a pecuniary penalty according to the circumstances of the case.

Affiliation.— Used to denote the act of determining the paternity of a child, that the obligation for its proper maintenance may be judicially fixed.

Affirmance.— The confirmation by a higher court of the findings of a lower court.

Affirmative.— A term used in judicial proceedings to designate the side upon which the burden of proof must fall.

Aiding and Abetting.— In criminal law, a term used to denote the act of a person who, while not directly responsible for the commission of a felony, has supported, sustained and rendered aid to its perpetrators.

Aleatory Contract.— A term used in civil law to denote that this document, is a contract, the fulfilment of the conditions of which depends upon a contingent event.

Allowance.— A term used in law to denote an extra sum awarded in addition to regular costs.

Ambidexterity.— A term applied to the act of a juror who takes money from both parties to a suit and who promises to render his verdict in favor of each of them.

Ambulatory.— A term used in civil law to denote that a thing is capable of being altered; thus, the return of a sheriff is ambulatory until it has become a matter of record.

Amercement.— Synonymous with affeerment.

Amicable Action.— A term used in law to denote that the action at issue has been commenced and is being prosecuted by mutual consent of both parties to the proceedings, in order that they may obtain the decision of the court on the matter as a question of law.

Amortization.— The conveyance of property to a corporation.

Ancestor.— In law, one who has preceded another in the possession of an inheritance, whether he be a progenitor or a collateral relative.

Ancillary Letters of Administration.— In law, the term "ancillary" denotes that the administration is a local and subordinate one, covering such part of the assets of a decedent as are not only without his domicile but which the law requires should be collected and applied to the satisfaction of the claims of creditors, the surplus being remitted to the principal administrator.

Annulment.— A judicial act making void retrospectively as well as prospectively, as in the annulment of a marriage.

Antecessor.— Synonymous for an ancestor.

Appellant.— The person appealing, or removing a cause from the lower to the higher court.

Appendant.— Any right or privilege that may pass with an inheritance.

Application.— In civil law, the appropriation of a debtor's assets among several creditors when the payment is insufficient to meet all obligations in full.

Appointment.— The designation, by a person having the right to do so, of a beneficiary to take the use of an estate created under a previous will or deed.

Approver.— In criminal law, one who turns state's evidence by confessing his part in a felony and giving evidence against all his accomplices in the commission of the crime.

Arm.— In law an arm is any object that a man may take in hand while in anger with the intention of assaulting another.

Array.— (a) The act of empanelling a jury; (b) the jury itself.

Asportation.— Used in criminal law to denote the felonious removal of goods from one place to another.

Assay.— The examination of weights and measures by the legal standard.

Attempt.— An "attempt," to be a crime in law, must be an act done in part execution of the design to commit the felony; the mere preparation, without an effort at commission, not being a criminal offense.

Attendant.— In civil law, a person who owes a service to another.

Attentate.— (a) A question improperly attempted by an inferior judge; (b) something done after an extra-judicial appeal.

Attorn.— In civil law, to acknowledge tenancy under a person who was not the original landlord but who has since claimed to have become such.

Authentic.— Designating an action which has been executed with all respect to the formalities of law, performed by the proper persons and attested before the proper authorities. An "authentic act" in civil law is a deed that has been properly performed and attested before a proper magistrate.

Aver.— (a) To allege as a fact; (b) to offer in evidence.

Avoidance, Plea in.— A plea in which the defendant, without denying the plaintiff's allegation, introduces some new facts in the hope of evading its effect.

Bequest.— Personal property left to a person by will.

Bill in Equity.— The pleading in an equity suit in which the plaintiff explains the circumstances upon which he bases his prayer for relief.

Bill of Exceptions.— In common-law practice, a document drawn after a trial by the unsuccessful party in which he presents all the rulings complained of as errors at the time of trial, and all the exceptions taken thereto, in order that they may be considered by the court to which he has appealed. See **Bill.**

Bill of Particulars.— A document in which the particulars of the matter at issue are set forth in detail.

Bona Fide.— In law, designating an act done without fraudulent intent. Thus, a "bona-fide purchaser" is a person who has purchased something for the price asked and without notice of an adverse claim; a "bona-fide possessor" is one who possesses something without the knowledge that there are others who have a better right in its title.

Brief.— (a) A systematically arranged and concisely expressed, but formal, memorandum of the points of law or of fact that are to be brought out in argument or developed in the examination of witnesses at the trial; (b) a writ summoning the person upon whom it is served to answer to the action.

Burden of Proof.— A term used to denote the obligation which rests upon one of the parties to a legal action to produce sufficient evidence to establish the fact that he has alleged in his complaint under penalty of having judgment entered against him, and this burden is not shifted until the party upon whom it has first rested has submitted sufficient evidence to turn the presumption in his favor.

Capias.— In civil law, a writ directing that the person of the defendant be taken into custody. The most common kind of writs of capias are (1) the "capias ad respondendum," under which the body is taken to answer before judgment has been declared; and (2) the "capias ad satisfaciendum," which designates that the body execution was taken after judgment had been entered.

Caption.— A document or part of a document setting forth the time and place that an action at law has been taken, with the court of authority before which it was performed, and such other particulars as might be required to render it valid, all of which information must have been written upon or attached to the paper to which it relates.

Carriage.— A term used in equity practice to designate the party to whom the right of going forward with the proceedings has been entrusted.

Case.— The term applied to any suit, or action in court.

Cause.— A legal proceeding calling for judicial decision.

Cause of Action.— The condition of facts which entitles one party to bring action against another.

Cause to Show.— A term usually applied to denote an order from the court commanding a person to present a reason for some action, as why he should not be punished for contempt of court, etc.

Cesser.— (1) A term denoting that a person has neglected to perform the service or make the payment ordered by the court for two years; (2) a cessation, as of liability.

Cession.— The voluntary surrender of a debtor's assets to satisfy his creditors. Also termed "cessio bonorum."

Charge.— An address delivered by a judge at the conclusion of a trial in which he instructs the jury in relation to the points of law, the weight of evidence, etc.

Charging Part.— In a bill of equity, that part in which the plaintiff alleges other and anticipatory evidence, or introduces matter to which he wishes the defendant's answer.

Cheat.— A fraud committed by imposition. Such an act is punishable by law: (1) when it deprives another of his property, even when it is not great enough to amount to a felony; and (2) when it is accomplished by some method other than that of mere words, as in the use of false weights or measures or in the substitution of worthless articles for those of real value.

Claimant.— (a) One who brings suit to obtain something which he demands as his right; (b) in admiralty proceedings, this term is applied to the person who is permitted to defend an action "in rem" brought against certain goods in which he claims property right.

Claim Notice.— A term used in mining law to denote that a miner has posted a notification of his intended occupancy upon a piece of public land.

Clause.— (a) A term used to denote a collocation of words which might be removed from the instrument without affecting its intelligibility; (b) used to specify a distinct proviso, as a clause in a contract. The term "assumption clause" denotes a stipulation frequently inserted in a deed to property upon which there is a mortgage or other incumbrance, that, under its operation, the payment of said debt may be assumed by the grantee to the exoneration of the original debtor. The "Enacting Clause" is the leading declaration of a statute, which usually begins "Be it enacted," etc. An "Interpretation Clause" defines the meaning and limitations of words used in an act, while the "Saving Clause" is that which exempts something which might otherwise be included in the operation of the instrument or statute.

Codicil.— An instrument containing anything which a testator might wish to add, revoke or explain in relation to his will. Although supplementary to the will itself it is actually a part of it. See **Will.**

Cognizance.— (a) A plea admitting the facts as alleged in the declaration; (b) in actions for replevin, a plea that the defendant holds the goods in question contrary to his right; (c) the action of a court in taking authoritative notice of a cause.

Collateral Ancestors.— A term used in civil law to denote relatives, or antecessors who are not progenitors.

Collateral Facts.— Facts considered foreign to the matter at issue.

Collateral Issue.— Something outside of the main question at issue.

Collateral Proceedings.— Proceedings brought, not for the direct purpose of impeaching the prior proceedings, but as a fresh action, as opposed to a "direct" action.

Collateral Security.— Additional security.

Collateral Testimony.— Confirmatory testimony.

Collation.— A term used in civil law to indicate that former advancements of a decedent's property have been returned in order that the estate may be equitably divided among all the heirs.

Collocation.— The allotment among creditors of the proceeds of a judicial sale that has been made to satisfy their claims.

Collusion.— A term used in law to denote a private, or secret, understanding by which two or more parties agree to act as though at variance with one another in order that they may prejudice those who are not a party to their secret and so obtain a remedy to which they are not legally entitled.

Comity of Nations.— A term used in international law to define that spirit of courtesy which causes one nation to recognize the laws and institutions of another in such a manner as to permit them to take effect within its own territory.

Commercial Law.— The term by which the laws relating to commerce are known. These include all laws regarding shipping, bills of exchange, insurance, brokerage and general commercial affairs. See Commercial Law.

Comminatory.— Designating an act of imposing such a heavy forfeiture in a business transaction that it cannot be enforced in a court of justice.

Common Law.— A term used to define that body of law that has been derived from such sources as the reports of adjudged cases, from the opinions of legal authorities, and from popular usage and custom, rather than from any statutory enactments. See Law, Common.

Community Property.— A term used in civil law, and in the statutes of several States, to designate the property of husband and wife, exclusive of the antenuptial property of either, and of the property secured by either through the avenue of bequest or gift.

Compensation.— Used in civil law to denote the annulment of a debt by a counterclaim which the debtor holds against his creditor. See Mandate.

Compensatory Damage.— A term used in civil law to define such damage as may have been estimated as a fair equivalent for the injury received.

Competence.— (a) Legal right and authority to act; (b) also used in regard to evidence to denote its legal fitness to be heard.

Complainant.— The plaintiff in, or one who commences, a legal action against another, or in whose behalf a criminal prosecution is instituted. The claim for relief upon which such an action is brought is commonly known as the complaint.

Conclusion.— (a) The decision or finding in a case; (b) the end of a pleading; (c) an estoppel or bar by which one is held to the position which he has taken. A "conclusion of fact" is a decision on the part of a judge or referee as to the actual facts in the matter at issue; a "conclusion of law" is a similar decision in which the legal rights and obligations of the parties to the action resulting from the conclusion of fact are clearly specified.

Conclusive Evidence.— A term applied to testimony that possesses such weight as to preclude any contradiction of the fact in question.

Concurso.— A term in civil law usually applied to the litigation, or opportunity for litigation, which exists when several creditors, acting adversely to one another, claim the right to share in an estate, the object being to make one accounting cover all the claims against the fund.

Concussion.— Used in civil law as a synonym for extortion.

Condonation.— Used to denote an act of remission by which a husband or wife pardons a matrimonial offense which one knows that the other has committed by permitting the guilty party to return to all conjugal privileges. It is by such an act that the innocent party loses all right to seek a remedy for the offense in question.

Confirmation.— Used in civil law to denote the perfection of the title in an estate or possession.

Conflict.— Used legally to indicate the opposition existing between the laws of various jurisdictions when an effort is made to apply them in reference to each other.

Confusion.— A term used in civil law to denote the extinction of an obligation owing to the fact that the two persons necessary to its continuance have become one person, as when one has become the heir of the other, etc.

Conjoint.— Used in civil law to indicate a person who has a mutual interest with another in an enterprise or obligation.

Connivance.— The act of having a secret understanding with another; usually employed in relation to a wrongful act.

Consideration.— A term used in law to denote the remuneration that a contracting party accepts in exchange for something else or in return for a service rendered. A "concurrent consideration" is a consideration received at the time of the making of the agreement; an "executed consideration" is one previously received; an "executory consideration," one to be received at a date subsequent to the agreement. The term "good consideration" is used to define that natural love and affection which is usually considered an adequate motive for the transfer of property without a valuable equivalent, except as against creditors. A "valuable consideration" is an equivalent that must be admitted to be of pecuniary value. "Want of consideration" is the lack of any equivalent whatever, and "failure of consideration" denotes that an apparently good equivalent has afterward become worthless. See Mandate.

Consolidation.— Used in civil law to denote the merging of the profit of land with the property.

Construction.— (a) Used to denote an intelligent reading with such explanations as may be necessary to define the meaning of the text; (b) when uncertainty exists as to the actual intent of an instrument; any altered reading of the text designed to show its proper application is also termed a "construction."

Contempt.— A term usually applied to define the disobedience to, or open disrespect for, a court or legislative assemblage that has come to be known as "contempt of court," an offense that may be committed either in or outside of the courtroom, and which is punishable by commitment to prison or by the imposition of a fine. The term "constructive contempt" is applied when the offense, while not committed in the presence of the court, is of such a character that the law is obliged to take cognizance of it, whether it was performed intentionally or not. Any wilful or aggressive disobedience or disorder is termed "criminal contempt," while an act committed in the presence of the court is known as a "direct contempt." A person who has been committed for this act against the dignity of the judiciary, and who has not purged himself therefrom, is said to be "in contempt."

Contraband.— The term applied to goods that are prohibited from importation or exportation by the laws of the country. Such goods, when handled illegally, subject one to the charge of smuggling.

Contract.— Used in the civil law to denote a document in which the rights and agreements of the two or more parties concerned in the obligation are specifically defined that they may become enforceable by law. Among the many terms used in relation to the making or execution of contracts, the following are among those which are most commonly employed: Accessory contract, one made to secure the performance of a previous contract; aleatory contract (q.v.); bare contract, an unconditional surrender or agreement; commutative contract, one in which each party gives and receives an equivalent; contract of record, one that had been entered before a judicial tribunal, as a judgment, etc.; executed contract, one in which the thing agreed upon has been done; executory contract, one in which the thing agreed upon has yet to be done; express contract, one in which the agreement is expressly stipulated in writing; gambling contract, one in which the parties agree to make good all differences that may be occasioned by chance within a specified time, but such contracts cannot be enforced at law; implied contract, one that may be imputed by construction, as when by some valuable exchange or service rendered justice demands that the contract be carried out as implied; indeterminate contract, one in which the terms cannot be fixed until other motives act; joint contract, one in which the parties are bound to perform all the obligaitons of the agreement, or are entitled to receive the benefit of them; mutual contract, one in which the obligation assumed by each party is in view of the obligation assumed by the other party; oral contract, one depending upon word of mouth alone; simple contract, a contract not under seal; special contract, one in which the thing to be done is specified in detail under seal; verbal contract, same as oral contract; voidable contract, one liable to be made void but which is binding until such notice is given; void contract, one that is not legally binding upon either party. See Contract.

Contribution.— In civil law, the amount levied upon each of several persons having mutual interests in the same enterprise to equalize the loss suffered or the payments made. A "suit for contribution" is an action brought to compel the payment of such proportionate shares.

Conversion.— (a) An unauthorized attempt to exercise the rights of ownership over personal property belonging to another; (b) an assumption in equity that real property has been converted into personal property or vice versa when the owner has shown in a proper manner that such was his intention.

Corpus Juris Civilis.— Body of the Civil Law.

Cost.— The sum fixed by law as the amount to be charged as the expense for bringing suit. In actions at law such costs are usually aggregated that they may be paid by the losing party when final judgment is entered.

Courts-Martial.— See Law, Military.

Covenant.— In civil law, any agreement under seal.

Covert.— A term used to denote that a person is under protection; usually applied to a woman, and especially to one who is married.

Covin.— An agreement in which two or more parties have entered into collusion to the detriment of another party.

Credible Witness.— One who is qualified to testify and who cannot be impeached as unworthy of credit.

Creditor's Action.— (a) The term applied to a bill in equity, in which one or more creditors, acting for all other creditors, seek to reach assets that could not legally be sold on execution that they may obtain an accounting and due settlement by law; (b) the same term is applied to the bill that may be brought by creditors seeking to set aside a transfer of assets as a fraudulent transaction.

Criminal Law.— That body of law which relates to crimes and their punishment. See Law, Criminal.

Cross-action.— A suit brought by the defendant in a previous action against the plaintiff therein.

Cumulation.— A combination of causes for action, or defenses, so joined that all must be tried together.

Curia Advisari Vult.— A term denoting a postponement after argument to give the court time for deliberation.

Dative.— Designating something that may be disposed of at pleasure.

De Bene Esse.— A legal term denoting that a thing is taken for what it is worth, as in the case of testimony that may be suppressed after more full examination.

Declaration.— The pleading in which a plaintiff explains his claim for relief in a civil action.

Dedicate.— To surrender voluntarily (private property) that it may be applied to public uses.

Dedit.— In Canadian law, the sum stipulated to be paid as a penalty in case of breach of contract.

De Domo Reparando.— (a) The term applied to a common law writ issued to a houseowner against a neighbor whose building is in danger of falling with damage to the plaintiff's property; (b) a writ issued against a cotenant to compel him to show cause why he should not share in the expense of repairing property held in common.

Deed.— A document, under seal, made for the purpose of conveying real estate. See Deed.

Deforcement.— In civil law, the withholding of property to which another person holds the rights but of which he cannot gain possession.

Degree.— The term applied to the distinctions made in the culpability of various persons who have violated the criminal law; thus, the active perpetrator is charged with crime in the " first " degree; those who aided or abetted him, in the " second " degree.

De Jure.— A term implying right according to law.

Delegation.— A term applied in civil law to denote that a debtor has freed himself from the responsibility for his debts by offering another person who binds himself to assure their payment.

Delivery.— In civil law, the act of placing a person in legal possession of any property.

Demise.— In civil law, a term used to denote a lease for a number of years.

Depart.— To deviate in one pleading from the defence made in a prior pleading.

De plano.— Used in law to denote that a thing is so manifestly right as to require no argument.

Determinable.— A term used in civil law to denote that a thing is liable to termination by uncertain contingencies.

Detinet.— A common law action of debt in which it is alleged that the defendant held back money that should have been paid to the plaintiff.

Devest.— A term used as a synonym for deprivation of title.

Dictum.— An opinion of a judge, but not the deliberate determination of the court.

Diminution.— Used to denote that an omission has been made in the records of a case sent from a lower to a higher court for review.

Disclaimer.— (a) A refusal to accept a position, as trustee of an estate or executor under a will; (b) a plea by which the defendant abandons all claim upon or interest in the subject at issue; (c) an instrument by which a patentee abandons a part of his claim of invention.

Discontinuance.— A term used to imply that a suit has been terminated through the action of the plaintiff.

Discretion.— A judicial power that is exercised purely upon personal judgment in view of existing circumstances and not upon application of any rules of law.

Dismission.— Rejection of a suit by the court on the ground that it is unworthy of maintenance.

Distrain.— To seize and hold another's goods in order to apply them to the satisfaction of the distrainor's claim, or to maintain possession of them until such a claim is settled.

Disturbance.— In common law, the wrongful obstruction of any party in the enjoyment of his personal rights.

Divestiture.— In civil law, the act of abandoning one's effects.

Doli capax.— A term used in common law to denote that a child is of sufficient age to be able to distinguish the difference between right and wrong.

Dominus.— In civil law, the person who maintains possession of something by right.

Donation.— In civil law, the transference of something from one person to another without consideration.

Dower.— The portion of a husband's estate which reverts to the wife upon his death.

Duplicity.— Used to define the act of pleading two or more distinct matters together as if they constituted only one.

Duress.— Used to denote the exercise of such restraint as to practically amount to coercion. "Duress of goods" is the forcible seizure of goods without authority to force the claimant into settlement; "duress of imprisonment" implies actual personal restraint; "duress per minas', denotes coercion effected by threats of personal injury to life or limb. In law, no promise or agreement is held to be binding if made under duress.

Elegit.— (a) A judicial writ of execution; (b) a title to land held under such writ.

Elimination.— A term frequently used as a synonym for ejectment.

Encumbrance.— The amount for unpaid services or public charges that rest upon a property to diminish its value even through changes of ownership.

Enjoin.— The act of restraining a person by means of a judicial injunction.

Entireties, Tenancy by.— A tenure created when an estate is divided or conveyed to a man and his wife during coverture.

Escrow.— A writing that has been fully executed but which has then been placed in the hands of a third party, to be held by him until such time as the specified conditions under which the instrument was prepared have been fulfilled.

Esplees.— A term used to denote the products of the land, whether in produce, rents, or otherwise.

Evocation.— In law, the act of taking an action from one court for the purpose of carrying it to a higher court.

Exaction.— An offence committed by officials in authority who exact or take a fee when the law requires that none be paid.

Exception.— (a) A term most frequently used to denote the action in common law practice by which all objections made to the rulings of a court are noted in writing that they may be submitted to a higher court as an explicit reason why an appeal should be granted; (b) a clause in a conveyance exempting some portion of the estate from the sale; (c) a writing employed in a case in equity to indicate the particular portions of an adversary's pleadings to which objection has been taken.

Exchange.— In civil law, a reciprocal transfer of property in which no financial consideration is offered or required.

Executor de son tort.— One who attempts to settle the affairs of a deceased person without authority.

Ex facie.— A term used to denote what may be assumed from the face of a writing.

Expatriation.— The act of renouncing the country of one's birth to become a citizen of another country.

Expromissor.— In civil law, one who binds himself to pay the debts of another person.

Extend.— In civil law, to seize lands in satisfaction of a debt.

Extortion.— (a) A gross overcharge which could not be upheld in law; (b) the act of obtaining money from another person when none, or a smaller amount, is due.

Extradotal.— In civil law, that portion of a woman's property that is exempt from consideration under dower right.

Factum.— The term used to denote the statement of a case to the court.

Fee.— An estate held in trust. When it is vested in the owner and his heirs and assigns forever, it is commonly known as a "fee simple."

Feigned Issue.— A term used to denote that the issue has been prepared for court by agreement, or by judicial order, rather than by the ordinary procedure.

Fiduciary Capacity.— A term often used to denote that the position occupied by the party referred to was one of trust and confidence, the idea being that violations of such confidence are not covered either by discharge in bankruptcy or by the laws and rulings regarding imprisonment for debt.

Fieri facias.— A civil law writ that may be issued after judgment, empowering the sheriff to levy upon goods or lands to secure the amount due.

Forbearance.— In civil law, the act of restraining the enforcement of one's legal rights.

Force and Arms.— A term used to denote that the act complained of was done with violence.

Forcible Entry.— The act of taking possession of property by means of threats, or by arms, etc.

Foreign Attachment.— The process of seizing the local property of an absent debtor in order that he must either put in an appearance or allow the claims of the creditor to be satisfied.

Foreign Matter.— Actions that must of necessity be tried in some other county.

Forfeiture.— The act of having one's property transferred to another as the result of one's negligence or by reason of the misdeed of another person.

Furniture.— In civil law, personal chattels in use by a family, and, ordinarily, exempt from legal process.

Gage.— A term used to denote the personal property that has been placed in a creditor's hands by a debtor as security for the payment of his indebtedness.

Gager del ley.— Used synonymously with a "wager of law."

Garnishee.— The person who takes possession of the money or property of another with the avowed intent to keep it to answer the claim of the creditor, or until the defendant is otherwise discharged.

Gift.— In civil law, a conveyance that is made without consideration, either in blood or money.

Giving Time.— In civil law, an agreement by which all the creditors agree to give a debtor time to pay his debts instead of forcing him to abide by the terms of the first agreement.

Go Without Day.— A term used to denote that a case has been dismissed from court.

Grant.— (a) A generic term applied in civil law to all transfers of real estate; (b) the instrument by which the transfer is made, or the property which is so transferred.

Gross Negligence.— A term used to indicate that the ordinary care which even a thoughtless man might take of his own person or property has in this instance been omitted.

Habeas corpus.— A term used to denote a writ issued to parties suspected of detaining another, and commanding them to produce the body of that person at a certain time and place, there to submit to such judgment as the court may see fit to make in the matter. This habeas corpus action is one of the most famous in law, it having been used so often to protect human rights that it has come to be known as the "Great writ of Liberty." See Habeas Corpus.

Habitation.— In civil law, the right of an individual to live in a house owned by another person without prejudice to the property.

Habitual Criminals.— Persons who are so well known as malefactors by reason of their criminal past history and associations as to be punishable by penalties of more severity than are ordinarily imposed upon persons who have no such record against them.

Hearsay Evidence.— The term applied to testimony that cannot derive its value in credibility from the witness himself, but must depend largely upon the veracity of another person.

Heritage.— In civil law, every kind of immovable property, whether acquired by purchase, descent, or otherwise.

High Seas.— A term often used in the settlement of questions of jurisdiction, etc. It denotes the unincloased water of the ocean and all those of the sea-board that may be beyond the boundaries of the low-water mark.

Hold.— Used technically in civil law as a part of the term "To have and to hold," the clause known as the "tenendum," by which the grantee's tenure to the land in question is expressed.

Homologation.— A term used in civil law to denote the approbation of the award and order necessary before execution may take place.

Hypothecation.— A term used in civil law to denote a creditor's right over a debtor's property: the power to cause it to be disposed of by sale that he may secure his payment from the proceeds. There are various forms of hypothecation recognized by law: Conventional hypothecation, or those effected by the agreement of parties; general hypothecation, as when a debtor hypothecates his entire estate for the benefit of his creditors; legal hypothecation, those that are not dependent upon a contract or agreement; special hypothecation, or the hypothecation of a special estate; and tacit hypothecation, as when ordered by the court to secure a debtor's creditors.

Immaterial Averment.— In pleading, a statement of unnecessary particulars sometimes included in connection with, or as description of, what is actually material to the case.

Immoral Consideration.— A term used to define a contract based upon something which is contrary to good morals; such contracts usually being void.

Immovables.— A term used in civil law to denote that kind of property which from its own nature or by its situation cannot move itself or be removed without great difficulty.

Imparlance.— A term denoting the continuance of a cause for a few days to give one of the parties to the issue time to answer the pleadings of his opponent.

Impediments.— In civil law, the legal hindrances in the making of contracts, as minority, lack of reason, coverture, etc.

Imperium.— A term used to define a power that vests only in the executive: The right to call upon the military forces of the State to enforce its statutes.

Impertinent.— A term used to denote that certain matters that have been introduced into a bill, answer, or other proceedings in equity, are not properly before the court.

Improvement.— A term used in civil law to denote the betterment in the condition of a property due to the expenditure of labor and money.

In fraudem legis.— A term used to imply that a thing is "contrary to the law."

In Full Life.— A term used to indicate that a person is neither physically nor civilly dead.

In loco parentis.— Literally, in place of a parent.

In pari causa.— A term employed to denote that two parties are in equal right according to law, in which case, according to usage, the party having possession is regarded as of best right.

In pari delicto.— A term indicating that both parties to an issue are equally at fault, a case in which no relief can be obtained.

In propria persona.— Literally, in his own person.

In solidum in solido.— A term used in the making of a contract, and meaning, "For a whole as a whole."

In statu quo.— Literally, in the same condition as before.

In toto.— Used legally to imply "in the whole."

Inalienable.— Designating properties that cannot be transferred from one to another, as the public highways, parks, etc.

Incompatibility.— A term denoting the incapability of two persons to exercise the rights and privileges when together, as in the case of landlord and tenant, husband and wife, etc.

Indirect Evidence.— A term used to denote that kind of evidence that, while it does not establish the fact in question, furnishes a presumptive proof in its favor.

Inducement.— Employed in civil law to denote the consideration, or benefit which was used to induce the promisor to make the contract in question.

Induciae.— Used in civil law to indicate the declaration of a truce in judicial hostilities.

Injuria absque damno.— A term used to imply that the wrong incurred was without damage or loss, in which the action at law cannot be maintained.

Jeopardy.— The condition of a prisoner when a trial jury has been impanelled and sworn to try his case. If he escapes this jeopardy he cannot again be subjected to the same danger, the United States Constitution clearly defining that point that "No person shall be subject for the same offences to be twice put in jeopardy of life or limb."

Joinder.— (a) In civil law, the merging of several causes of action in a single declaration; (b) in criminal law, the act of joining several cases of the same nature in one indictment; (c) acceptance by both parties to an action of an issue tendered.

Joint Action.— A term used when two or more persons are alike parties to a suit, as two or more plaintiffs against two or more defendants.

Jus abutendi.— A term meaning, literally, the right to abuse, but generally employed to denote that the party in question has every possible right over his property.

Justifying Bail.— A term used to denote that the parties who have been produced as bail have been able to justify themselves in spite of any exceptions taken by the opposition.

Labor a Jury.— A term used to denote that an effort has been made to reach the jury for the purpose of tampering with it, or affecting its decisions.

Laches.— Neglect to perform a certain duty or to protect a claim at the proper time.

Law of Equity.— See Law.

Law of Merchants.— See Law.

Law of Nations.— See Law.

Lese Majesty.— Apparent disrespect for a monarch. In some countries such an offense is treated as treason.

Letters Testamentary.— An instrument in writing, granted by a judge or other official having authorty and jurisdiction over the probate of wills, making it known that the will in question has been proved in proper form and that the estate is in order to be administered.

Levitical Degree.— A term used in law to denote the degrees of kindred that are prohibited in the 18th chapter of Leviticus.

Lex loci.— A term used to denote the local law, or, literally, the law of the place.

Liquidated Damages.— Damages, the amount of which have been decided upon by an anticipatory agreement between the parties concerned.

Made Known.— A term used to denote that a writ of scire facias has been duly served upon the defendant.

Mainour.— A term which literally means "found in hand," and which is used in criminal law to denote that the goods stolen were found with the person who stole them. "To be taken in the mainour," therefore, is synonymous with being caught in the act.

Maintenance.— A term used in law to denote any officious interference with the course of justice.

Malfeasance.— A term used to denote the unlawful or wrongful conduct of a public official in office.

Malpractice.— A term denoting bad medical practice, whether due to ignorance, carelessness, or criminal intent.

Malum in se.— A term denoting that an act is evil in itself, in counterdistinction to the offenses that, while not naturally evil, have become so because of the fact that they have been specifically prohibited.

Manbote.— The compensation paid to the relatives of a murdered man by the murderer, or on behalf of the latter.

Mandamus.— A writ issued by a superior court by which an inferior court, a corporation, or other body is directed to perform some act therein specified on the ground that it is a part of their office and duty. A writ of mandamus which couples this command with an alternative to the effect that if this act be not done the party commanded to perform it must show cause why this order has not been obeyed, is termed an "alternative mandamus"; a writ in which the command of the superior court is absolute, is termed a "peremptory mandamus."

Manu forti.— A term used in pleading to denote that the entry was the most forcible that could be made.

Matter in Deed.— A matter that may be proved by deed.

Matter of Fact.— A matter that may be referred to a jury, as its truth is a question that may be determined by the senses, or decided upon evidence.

Matter of Law.— A matter the truth or falsity of which must be decided by established rules of law.

Matter of Record.— Matter that may be proved by the production of an authentic record.

Mercantile Law.— That branch of law in which the rights and duties arising out of mercantile relations are defined.

Metes and Bounds.— A term used to define the boundary lines of lands.

Misfeasance.— The performance of official or legal duty in an improper manner by a public official.

Misjoinder.— A term used in pleading to denote the improper union of causes of action or of persons in a single suit at law.

Moral Certainty.— A term which denotes the degree of certainty by which a jury is justified in determining its verdict.

More or Less.— A term used to convey the impression that the quantity of the matter at issue is uncertain and that neither party shall find cause for complaint in its deficiency or excess.

Mulct.— The fine imposed upon the conviction of an offender for the commission of an offense.

Municipal Law.— See Law.

Mystic Testament.— A term used to define a will under seal.

Natural Law.— See Law, Natural.

Ne baila par.— A plea in detinue, in the making of which the defendant denies that the thing sued for was ever delivered to him.

Never Indebted.— A plea in which the defendant asserts that he is not indebted to the plaintiff for the amount sued for.

New Promise.— A new contract made after the original agreement has become invalid and by the terms of which the signers agree to fulfil the stipulations of the prior contract.

Newly Discovered Evidence.— A term used to denote that the proof of new facts that have been obtained since a verdict was rendered are of sufficient importance to affect the decision of the court.

Nihil dicit.— Literally, he says nothing. A term used to denote that judgment may be taken by default.

Nihil habet.— Literally, he has nothing. A term used in the return made by the sheriff who has been unable to discover the property required under a writ of scire facias, etc.

Nominal Damage.— A term used when a trifling sum has been awarded in a case where a breach of duty, or an infraction of the plaintiff's rights, has been shown, but by which no serious injury or loss had been sustained.

Nonfeasance.— Refusal or failure by a public official to perform a legal or official duty.

Nul tort.— A plea to a real action in which the defendant enters a denial of any wrong.

Nulla bona.— A term used in a return to a writ of fieri facias denoting that there are no goods upon which a levy may be made.

Optional Writ.— A writ which contains the alternative providing that if a thing is not done cause must be shown as to why it was not done.

Organic Law of the State.— See Law, Constitutional.

Oyer and Terminer.— Although this name was originally applied only to an English court for the trial of indictments, it has since been adopted in some portions of the United States as the title of the higher courts of criminal jurisdiction. See Court.

Particeps Criminis.— A term used to denote that a party is a partner in the crime alleged.

Pendente Lite.— A term used to denote that a matter is in statu quo pending the action of the court.

Peremptory Challenge.— A privilege permitted in criminal cases when the prisoner's counsel is granted the right to make a specified number of challenges of jurors without giving his cause.

Perpetuating Testimony.— A term applied to testimony that has been reduced to writing and duly attested according to law that it may be preserved to be read in evidence at some action not yet instituted.

Plaintiff and Defendant.— See Law.

Positive Fraud.— A term used when the deception in question was not only successful but was so clearly intentional as to be beyond the possibility of doubt.

Precarious Right.— A right that the owner has transferred to another person that the latter may enjoy it until it shall please him to revoke it.

Procès Verbal.— In French Canadian law, an act or process of apportioning the expenses for the building and maintenance of public utilities, as bridges.

Quiet Enjoyment.— A term employed in covenants or leases by which it is agreed that the vendee or lessee shall be permitted to peaceably enjoy the premises.

Quo Warranto.— A term derived from the name of a writ issued to compel a person or a number of persons to show by what warrant they have assumed the duties of a public office, trust, or franchise. It is, accordingly, the remedy which must be resorted to to oust usurpers from office.

Rate.— In Great Britain, an amount levied upon property in the nature of a tax for legal purposes.

Real Covenant.— A term applied to the signed and sealed agreement by which two or more persons bind themselves to pass a real thing.

Rebutting Evidence.— The testimony in a trial in which the defendant makes answer to the plaintiff's surrejoinder.

Recoupment.— The term applied to the right accorded the defendant to claim damage, in the same action, from the plaintiff because of his failure to comply with some cross-obligation or his violation of some duty imposed upon him by the terms of the contract.

Rejoinder.— The term applied to the fourth stage in the pleadings in an action at common law, in which the defendant makes answer to the plaintiff's replication. A surrejoinder is the next pleading of the plaintiff.

Replevin.— A term applied to a personal action brought to recover possession of goods that have been wrongfully taken or detained, security being given by the complainant to try the right to their ownership by means of a regular suit at law, and to return the goods replevined if such action should be determined in favor of the defendant. A "replevin in the cepit" is an action in which it is claimed that the defendant wrongfully took the goods, while a "replevin in the detinet" is an action claiming that he wrongfully detained them.

Salvage.— See Law, Maritime; Salvage.

Separate Maintenance.— An allowance made by a husband for the support of his wife from whom he has separated.

Specification.— A detailed statement or description, as of a patent.

Stoppage in Transitu.— The resumption by the seller of either the actual or constructive possession of goods that have not been paid for while on their way to the vendee but before the latter has acquired actual possession of a property right in such articles.

Subornation of Perjury.— The term applied to the act by which another person is persuaded to commit the crime of perjury. See Perjury.

Tender.— A term denoting an offer to deliver something in satisfaction of a debt, or to give to the other party the specific thing required by the contract in question.

Transfer.— (a) The act of conveying property, right, or title from one person to another; (b) the removal, as of a cause, from one jurisdiction to another.

True Bill.— When an indictment is found against a party accused of a felony before the grand jury the finding is termed a "true bill." See Law, Criminal.

Ultimatum.— In international law, a final statement, as of one power to another, before breaking off friendly negotiations.

Under and Subject.— A term used in instruments for the conveyance of land, indicating that the party taking it accepts the transfer subject to the mortgage upon it.

Vadium Mortuum.— Literally, a dead pledge. A term used to denote the security given in the form of a mortgage by which the lender agrees that if the money borrowed is not repaid at the time specified the estate shall pass to the lender.

Vadium vivum.— Literally, a live pledge. A term used to denote a pledge given in the form of a mortgage under which the lender agrees to take the sum borrowed out of the profits of the land.

Without Prejudice.— A term used in cases of overtures and communications between parties to an action at law by which it is specified that should the negotiations fail to result in the adjustment of the controversy nothing that has transpired at such meetings will be taken advantage of at subsequent hearings before the court, but all will be regarded as "without prejudice" to the matter at issue.

Yielding and Paying.— A term used in the writing of a lease that it may constitute a covenant on the part of the lessee to pay the rent stipulated.

LEGARDEUR DE SAINT-PIERRE, Jacques. See Saint-Pierre, Jacques Lagardeur de.

LEGARE, la-gre, **Hugh Swinton**, American statesman: b. Charleston, S. C., 2 Jan. 1797; d. Boston, Mass., 16 June 1843. He was graduated at the College of South Carolina in 1814, and subsequently studied at Edinburgh University. After a tour of Europe he returned home in 1820, and two years later entered upon the practice of law. In 1821 he represented his native city in the State legislature, and in 1830 was elected attorney-general. In the same year he established the *Southern Review*, a quarterly, with Stephen Elliott. In 1832 he was appointed chargé-d'affaires at Brussels. In 1836 he was elected to the lower House of Congress. In 1840 he was appointed by President Tyler Attorney-General of the United States. He was a brilliant orator and debater, and his contributions to the New York *Review* on 'Demosthenes,' the 'Origin of Roman Law,' etc., were marked by much literary ability.

LEGATE, an ambassador sent by the Pope and armed with his authority to represent him at the court of a foreign prince or state.

LEGATION, a diplomatic mission; also, the building in which the minister resides, and the area immediately surrounding it. A legation is usually deemed immune from the jurisdiction of the country in which it is situated, and to be subject only to the laws of the country which the Minister represents. It may therefore serve as a place of refuge for political offenders. All persons attached to a foreign legation are protected by the act of 30 April 1790, from violence, arrest or molestation (Fed. Cas. No. 2,278).

LEGAZPE, Miguel Lopez de, mē-gĕl lō'pāth dā lā-gäth'pā, Spanish soldier: b. Zumarraga, Guipuzcoa, about 1510; d. Manila, Luzon, 20 Aug. 1572. He was for several years chief secretary of the government of the City of Mexico, and in 1564 was made commander of the Spanish forces sent to the Philippine Islands. He sailed from La Navidad, Mexico, in November 1564 and reached the islands in the following February. He took possession of several of the islands and founded San Miguel in Cebu, in May 1565; began the subjugation of Luzon in 1570, and founded the city of Manila in May of the next year.

LEGEND, originally a term applied to collections of biographies of saints and martyrs or of remarkable stories relating to them. In the Middle Ages a collection of the lives of the saints was known by the name of Legenda Sanctorum, or Historia Lombardica. There is a celebrated collection, called the Golden Legend (Aurea Legenda), by Jacobus de Voragine, archbishop of Genoa, who died in the year 1298. It was translated into English by Caxton, and printed by him at the command of William, Earl of Arundel, in 1483. Many of the mediæval legends were of an uncritical character, and along with true history often mingled much fable. In the course of time the legend came to mean only the fictitious parts of the story and became distinct from authentic history. It has now come to mean any unauthentic or improbable story handed down from ancient times. Legend is also used for the motto or words engraved in a circular manner round the head or other figure upon a medal or coin. The meaning of this term is similar to that of *inscription;* but the latter refers chiefly to the writing placed in the middle of the coin, while the legend surrounds it.

LEGEND OF GOOD WOMEN, an unfinished poem of Chaucer, planned to embrace the lives of 19 women of antiquity celebrated through their devotion to Cupid, but of which he completed eight and a part of the ninth, supposed to have been written about 1685. While nearly all the stories used are in Boccacio's 'Declaris Mulieribus' there is doubt that Chaucer had ever seen that work. He followed the original authors, Ovid, Livy and others, and there are indications of influences from Virgil, Dante and Guido da Colonna. The prologue and 'Cleopatra' are considered among Chaucer's best work.

LEGEND OF SLEEPY HOLLOW, The, one of the stories in Washington Irving's 'Sketch Book' (7 parts, 1819–20). It deals with the tradition of the Headless Horseman, used to interrupt Ichabod Crane's courtship of Katrina van Tassel, and is one of the most popular tales in the book.

LÉGENDE DES SIÉCLES, lā'zhänd' dā zē-ā'kl, **La** (THE LEGEND OF THE CENTURIES), a collection of lyrical epic verse by Victor Hugo, published in 1859–77–83, and considered his finest work in this field.

LEGENDRE, Adrien Marie, ä-drē-ŏn mä-rē lė-zhŏndr, French mathematician: b. Paris, 18 Sept. 1752; d. Auteuil, France, 9 Jan. 1833. He was professor of mathematics in the military school at Paris and in 1783 became a member of the Academy. He was in 1787 employed by the French government, with Cassini and Mechain, to measure a degree of latitude between Dunkirk and Boulogne, while English mathematicians did the same on the other side of the Channel, in order to determine the precise location of the observatories of Greenwich and Paris. In 1808 Legendre was appointed by the imperial government councillor for life to the university. He particularly distinguished himself by profound investigations as to the attraction of elliptical spheroids, and his method of calculating the course of the comets attracted great attention. His best-known work is 'Eléments de géometrie' (1794; new ed., with additions and modifications by Blanchet 1845), which has been translated into English with notes by Sir David Brewster. He wrote also 'Essai sur la théorie des nombres' (1798); 'Nouvelle methode pour déterminer l'orbite des cometes' (1805); 'Exercises du calcul integral, sur divers ordres de transcendantes et sur les quadratures' (1811–19); 'Traité des fonctions elliptiques et intégrales Eulériennes' (1827–32), etc.

LEGENDRE, Louis, French revolutionist: b. Versailles, 22 May 1752; d. Paris, 13 Dec. 1797. He was a butcher, and at the outbreak of the Revolution he speedily became a leader through his untutored eloquence and personal magnetism. He was prominent in the taking of the Bastille, in the massacre of the Champs des Mars and in the attack on the Tuileries. He was a member of the Convention and voted for the execution of Louis XVI. He represented the Convention on missions to Lyons and Seine-Inférieure in 1793, was a member of the *Comité de Sûreté Générale,* and was instrumental in securing the fall of the Girondists. He deserted Danton after his arrest, and after the fall of Robespierre he was active among the reactionaries, opposed the Jacobin Club, which he had helped to found, and as president of the Convention was prominent in the impeachment of J. B. Carrier. He afterward was elected a member of the Council of Ancients.

LEGENDRE, Napoléon, Canadian poet and essayist: b. Nicolet, Quebec, 13 Feb. 1841; d. 1907. He was educated at Saint Mary's Jesuit College, Montreal, was admitted to the bar of Lower Canada in 1865, edited *Le journal de l'instruction publique* in 1871–76, and in 1876 was appointed clerk of the French journals of the legislative council of Quebec. He was an original member of the Royal Society of Canada. Author of 'Sabre et scalpel' (1872); 'Échos de Quebec' (2 vols., 1877); 'Les perce-Neige,' poems (1886); 'La langue française au Canada' (1892), etc.

LEGER, lā-zhā, **Louis Paul Marie,** French scholar and author: b. Toulouse, 13 Jan. 1843. In 1885 he was appointed professor of the Slav languages at the Collège de France, and has done much to awaken an interest in the history and philology of the Slav peoples by such works as 'Slav Studies' (1875); 'History of Austria-Hungary' (1878), translated into English; 'Slav Tales' (1882); 'The Save, Danube and Balkan' (1884); 'Bulgaria' (1885); 'Russians and Slavs' (1890); 'Russian Literature' (1892); 'Le Monde Slav' (2d ed., 1897–1902); 'Slav Mythology' (1902); 'Souvenirs d'un slavophile' (1905); 'Moscow' (1904); 'Prague' (1907); 'Serbs, Croats and Bulgarians' (1913). He was elected a member of the Institute in 1900.

LEGER (lĕj'ėr) **LINES**, in music the short lines drawn above and below the staff for those notes which exceed its compass; the corresponding spaces being called «leger spaces.» The term dates from about 1700 and its origin is disputed.

LEGERDEMAIN, lĕj-ėr-dę-mān', the art of deceptive juggling; variously styled prestidigitation, thaumaturgy or sleight of hand; or less correctly, magic. Properly, magic (q.v.) is the name for necromancy, divination, sorcery or unusual and apparently supernatural things accomplished by the aid of occult powers or discarnate spirits. The term magic has been popularly used by self-styled «magicians» who are really jugglers or sleight-of-hand performers, depending on their ability to trick or mislead spectators at a public performance, as in a theatre. The typical stage performer has a stock of tricks, depending largely upon the use of apparatus calculated to deceive or mislead, as boxes and pitchers with double bottoms or concealed compartments. There is much substitution of like objects, as coin, eggs, handkerchiefs, etc. The expert prestidigitator has a skilful knack of directing the attention of the public at the instant he substitutes one thing for another. It is this substitution that has suggested the terms — legerdemain (fine hand) and sleight-of-hand. He directs the attention to one thing when he wishes it removed from another. When the spectator is advised to watch slowly the movement of his hands, it is likely that the important thing is done with his foot, or by an attendant, etc. The simple juggler amazes one by the celerity with which he handles half a dozen balls, plates, etc., but the legerdemain artist goes farther and is satisfied only by imitating the impossible in the work of the true magician or spiritual medium. The successful thaumaturgist may carry with him considerable machinery for the performance of his deceptions. Some of these have become widely known and advertised, as the human head resting on a plate on a small table with no apparent body. In this trick, mirrors between the legs of the table hide the person who sits under with his head through a «faked» plate. These mirrors reflect drapery of the same color as that at the rear and the spectators appear to see right through and under the table. Another popular trick is that of locking a man in a trunk and then tying the trunk with many ropes, after which a curtain is dropped. Within a few seconds the man apparently walks out, carrying the opened trunk in his hand. The obvious explanation is that there are two similar trunks and two men — twins being hired for the performance. Robert Houdini was the first to bring real scientific methods to the aid of modern conjuring, and more recently the Herrmanns have been famous in this art. There is a well-known popular vaudeville deception carried on by the scientific use of liquid air. Here the performer appears to fry eggs on a cake of ice, whereas he simply freezes them.

Snake-charming is largely hypnotic, and it is believed that some of the East Indian performers in the open air simply hypnotize the beholders into the conviction that they see what does not really take place. Other tricks are undoubtedly magic, performed through occult knowledge not generally recognized, as telepathy, clairvoyance, materialization, etc. The true scientific conjurer makes one of optical delusions, as in the famous ghost trick; of reflections of sound; of expert and highly elaborate systems of signaling with a confederate; trap-doors, curtains, invisible wires, electrical contrivances, etc. For several hundred years there have been exhibitions of a person — usually a «beautiful lady» — suspended in mid-air, without apparent means of support. This trick undoubtedly has been accomplished in more ways than one. The method in case of «Astarte» was a supporting iron bar of the color of the back curtains that escaped detection. Another method, in which the elbow of the subject is allowed to touch a cornice, consists in using steel armor worn under the clothing and bolted to the cornice. Consult Smithsonian Annual Report ('Psychology of Prestidigitation') for 1894; Hoffman, 'Modern Magic'; Carter, 'Magic and Magicians' (1903); Cochrane, 'The Machinery of Amusement' (in 'Modern Industrial Progress,' 1905); Houdini, 'Unmasking of Robert Houdini' (1908); Elbiquet, 'Text-Book of Magic' (1913). See MAGIC.

LEGGE, lĕg, **James**, British Chinese scholar: b. Huntly, Aberdeenshire, 1815; d. Oxford, 29 Nov. 1897. He was educated at King's College, Aberdeen, and at the Highbury Theological School, London; was ordained and in 1839 went as a missionary to the Chinese. He was stationed at Malacca at the head of the Anglo-Chinese College until 1842 when the college was removed to Hongkong, where he remained for 30 years. He was an earnest missionary and realized the necessity for an understanding of the language and culture of China among his coworkers. He therefore began in 1841 a translation of the Chinese classics (8 vols., Hongkong 1861–73). In 1875 a chair of Chinese language and literature was founded at Oxford University for occupation by Dr. Legge and he remained there until his death. In addition to his numerous translations and works on Chinese religion he was author of 'The Life and Teaching of Confucius' (1867); 'The Life and Teaching of Mencius' (1875); 'The Religions of China' (1880).

LEGGETT, lĕg'ĕt, **Mortimer Dormer**, American soldier: b. Ithaca, N. Y., 19 April 1821; d. Cleveland, Ohio, 7 Jan. 1896. After graduating in medicine at Willoughby, Ohio, he studied law and was admitted to the bar in 1845. In the following year he was instrumental in organizing the first union free school system in Ohio. He was professor of pleadings and practices in Ohio Law College 1855–58, superintendent of the Zanesville (Ohio) public schools in 1858-62, and from 1862-65 served in the Federal army and was promoted to be major-general of volunteers in July 1864 and was commissioned major-general a year later. From 1871-81 he was United States Commissioner of Patents. From 1881 till his death he practised in Cleveland, Ohio.

LEGGETT, William, American journalist: b. New York, 1802; d. New Rochelle, N. Y., 29 May 1839. He was educated at the college in Georgetown, D. C., and in 1822 entered the navy as midshipman, but resigned in 1826. He had in the previous year published a volume of poems, ‹Leisure Hours at Sea, by a Midshipman of the U. S. Navy,› and in 1828 became editor of the *Critic,* a weekly literary journal, soon united with the *New York Mirror,* to which he contributed ‹Tales by a Country Schoolmaster› and ‹Sketches at Sea.› In 1829 he became one of the editors of the New York *Evening Post,* to which journal he was attached until 1836. He then commenced a weekly journal called the *Plaindealer,* which attained a large circulation, but was soon discontinued through the failure of its publisher. In May 1839 he was appointed by President Van Buren diplomatic agent to Guatemala, but died suddenly while preparing for his departure. His ‹Political Writings,› with memoir by Theodore Sedgwick, appeared in 1840. Leggett was remarkable among the journalists of his day as an unflinching advocate of freedom of opinion for his political opponents as well as for the men of his own party. Among his staunch friends was William Cullen Bryant. Consult Wilson, J. G., ‹Bryant and his Friends› (New York 1886).

LEGGETT'S, or BALD HILL, Battle of, an engagement of the Civil War, near Atlanta, Ga. The battle of Peachtree Creek (q.v.), 20 July 1864, was a Confederate defeat. On the 21st General Sherman advanced strong skirmish-lines to within about two miles of the works surrounding Atlanta. In the morning Leggett's division was ordered to carry a high, bare hill, situated about half a mile south of the Decatur Railroad. Supported on the right by Giles A. Smith's division, Leggett advanced under cover of the hill itself, dashed forward when reaching its base, drove Cleburne's Confederates from it and began to entrench. The Confederates made several vain efforts to retake it. From its summit Atlanta was in full view. Discovering at daybreak of the 22d that the advanced Confederate works had been abandoned, Sherman ordered a general advance along his line to occupy the city, and the movement began accordingly. During the night, however, the Confederate General Hood had abandoned his advanced lines on the left and ordered Hardee's corps of four divisions to march entirely past Sherman's left and attack his left and rear. Giles A. Smith's division of Blair's 17th corps held Sherman's left and Dodge's 16th corps was some distance in rear of the centre of Blair's corps and perpendicular to it. Blair fronted west, Dodge south.

About midnight Hardee moved out of Atlanta by the McDonough road, and about daybreak, when the troops had made a night march of 15 miles, and passed beyond Sherman's left, he halted, formed line and gave his men needed rest. In half an hour the order was given to advance and his corps went forward until Bates and Walther's divisions came to open ground, where they received a most deadly fire from Dodge's two Union divisions, which held them in check. Every effort to advance was repulsed with great loss and General Walther was killed. On the Federal side Gen. J. B. McPherson (q.v.), commanding the Army of the Tennessee, hastened troops to fill an interval between Dodge and Blair, rode to Dodge and then toward Blair's line, and had gone but a short distance when he fell mortally wounded, being succeeded in command by Gen. John A. Logan. Meanwhile the left of Hardee's line had enveloped Giles A. Smith's division, attacking it in front, flank and rear, Smith gradually yielding ground and refusing to connect his left with Dodge's right, the Confederates gradually advancing to the foot of Leggett's Hill. When Hardee's attack on Sherman's left and rear was being delivered, Hood ordered Cheatham's corps to attack in front, and the attack fell upon Leggett's Hill and the 15th corps on the right of it, just as Leggett had repulsed an attack in his rear. Leggett, by desperate fighting, held his ground. The Confederates made repeated attacks until nightfall, when Hardee withdrew his right wing, leaving his left connected with the entrenched line in front of Atlanta. On the right of Logan's corps the Army of the Ohio was attacked by Smith's Georgia militia, which was readily repulsed. On Hardee's right Wheeler's cavalry attacked Sprague's brigade in Decatur and for a time pressed it vigorously, but Reilly's brigade of the Army of the Ohio coming to its assistance, Wheeler was repulsed. The battle of Leggett's or Bald Hill was one of the greatest of Sherman's Atlanta campaign and involved four corps of his army and two of Hood's. The loss of the Army of the Tennessee was 430 killed, 1,559 wounded and 1,733 missing, with 10 guns; the entire Union loss during the day was about 4,000. The Confederate loss is not known; it has been variously estimated at from 6,000 to 10,000; it was probably between 5,000 and 6,000. Consult ‹Official Records› (Vol. XXXVIII); Cox, J. D., ‹Atlanta› (New York 1882); Sherman, W. T., ‹Personal Memoirs› (New York 1875); The Century Company's ‹Battles and Leaders of the Civil War› (Vol. IV, New York 1887-88).

E. A. Carman.

LEGHORN, lĕg'hôrn or lĕg-hôrn' (It. Livorno, lē-vōr'nō), Italy, a walled city and the third commercial port of Italy, in Tuscany, on the Mediterranean. It is the capital of the province of Leghorn, which has an area of 133 square miles and a population of about 135,765. It is about 200 miles northwest of Rome and 60 miles west of Florence. It is a well-built and clean city; the north part called Venezia Nuova, is intersected by canals along which are warehouses and stores, and a ship canal connects with the Arno. Leghorn has an inner and outer harbor and a good roadstead; the approach to the new dock has been deepened to 28 feet to admit of the entrance of large vessels. In the outer harbor is a lighthouse, built in 1303. Some of the manufactures are straw hats (originally the famous

Leghorn hats), leather, woolen caps, glass, paper, soap, coral ornaments, etc. Shipbuilding is one of its important industries, vessels for the Italian navy being constructed here. The chief exports are olive oil, borax, wine, marble, pumice stone, quicksilver, candied fruit, hemp, hides, soap, raw silk, etc. The chief imports are sugar, cotton, coal, tobacco, grain, spirits and petroleum. In the middle of the 16th century Leghorn had less than 800 inhabitants; but about this time it became a free port, the first one on the Mediterranean. After the decay of Porto Pisano, a neighboring city, Leghorn grew into importance. It has few building of the Renaissance period; a 17th century cathedral, a synagogue dating from 1581 and the royal castle are the principal public buildings. Some of the educational institutions are the Royal Commercial Marine Institute, the Royal Marine Academy, a library with over 72,000 volumes, a number of academies and seminaries. There are many charitable institutions. It is the seat of a bishopric and a United States consul. Leghorn is a popular summer resort and its connection by electric lines with the bathing places and with beautiful villages in the vicinity make it a most desirable place of residence at any season of the year. Pop. 105,315.

LEGHORN, a breed of domestic fowls. See POULTRY.

LEGHORN HATS, hats made in Tuscany from straw-plait obtained from bearded wheat cut green and bleached. They are so called because imported from Leghorn.

LEGION, in ancient Roman armies, a body of infantry consisting of different numbers of men at different periods, from 3,000 to above 6,000, often with a complement of cavalry. Each legion was divided into 10 cohorts, each cohort into three maniples and each maniple into two centuries. Every legion had 60 centurions and the same number of optiones or lieutenants and standard-bearers. The standard of the legion was an eagle.

LEGION, Theban, a Roman legion supposed to have been composed entirely of Christians, which upon refusal to participate in the persecution of their fellow Christians was by the orders of the Emperor Maximianus (285–305) twice decimated and finally exterminated. The legion was composed of 6,600 men recruited from the East and under command of Mauritius who later became the patron saint of Agaunum, Switzerland, the name of the town of their martyrdom being changed to Saint Maurice in his honor. The legend appears to have originated with Eucherius, bishop of Lyons, and while there are many later versions they supply details rather than change its outline. There has been much controversy concerning the authenticity of the story. It is alleged that nearly a century and a half elapsed between its supposed date and the first written record of it. Further arguments against it are that Christian soldiers were rarely executed but given their choice of sacrificing to the gods or being discharged, and that an entire legion would scarcely have been put to death at a time when Maximianus sorely needed troops. Consult ‘Acta sanctorum,’ edited by J. Bolland and others (Sept. vi, 308–49, 895–26), and Minge, J. P., ‘Patrologiæ cursus completus series græca’ (Vol. CLXXI, 1625–30).

LEGION, The Thundering, a Roman legion of the time of Marcus Aurelius. The substance of their story is that after driving the Marcomanni and Quadi from Hungary (174 A.D.), Marcus Aurelius and a portion of his army found themselves in a valley enclosed by high mountains and were in danger of perishing from thirst. The prayers of the Christian soldiers in the army brought the needed water in the form of a thunderstorm, which not only saved the army but put the barbarians to rout through terror and the swift attack of the Romans. The legend states that the legion was thereafter called the Thundering Legion in honor of the achievement. Of the actual occurrence of the thunderstorm and its assistance to Marcus Aurelius there is no doubt; but the name Thundering Legion (*Legió Fulminata*) had existed from the time of Augustus, and probably originated in the representation of lightning as the device on its shields. A marble pillar at Rome represents the deliverance of the army by means of the storm, but is not considered a memorial to the supposed prayers of the Christians. Dio Cassius in ‘Excerpta Ziphilin’ (I, lxxi, 8) states that the miracle was due to an Egyptian sorcerer. The letter of Marcus Aurelius, giving credit to the prayers of the Christians, printed in the first ‘Apology of Justin Martyr,’ is spurious. Capitolinus attributes the miracle to the prayers of Marcus Aurelius himself, while Tertullian supports the Christian legend.

LEGION OF HONOR, French Order of the (L'Ordre de la Légion d'Honneur), an order created by Bonaparte, First Consul, on 19 May 1802 (29 Floréal, Year X), to reward distinguished services rendered in military and civil life. The emblem of the *Légion d'Honneur* is a star with five twofold-rays, the centre of the star being surrounded by an oak and laurel crown, one side representing the French Republic (substituted for the emperor's head), with the inscription «République Française 1870,» the other side being adorned with two tricolor flags (substituted for the imperial eagle), and bearing the inscription, which has not been changed: «Honneur et Patrie.» The star, white enameled, is made of silver for the *Chevaliers,* and of gold for the other grades. The diameter is of 40, 60 or 70 millimeters (1.57, 2.36 or 2.75 inches), according to the grades. The badge is attached to a red-watered ribbon and worn on the left side of the chest.

The badge of the Legion of Honor, when worn by civilians or military and naval officers in civilian clothes, is a red-watered ribbon fixed to the left side buttonhole of the coat. The ribbon takes the form of a «rosette» or little rose for the higher grades.

The number of members of the order, originally provided by the law, was not to exceed 6,000, but this amount was very rapidly exceeded, and Napoleon himself, up to 1814, had granted the membership of the Legion of Honor to 36,825 individuals.

The first decorations were distributed with great solemnity to the «légionnaires» in Paris, Place des Invalides, on 14 July 1804 by Napoleon who, by that time, had become emperor:

the decorations were therefore distributed in his own name so that the new dignitaries had to swear fidelity to him; for that reason some distinguished individuals refused the crosses which had been offered to them, their personal convictions and principles not allowing them to recognize the establishment of the new régime. Among these distinguished objectors were Lafayette and Rochambeau.

Civil Medal.

Among the members of the first promotion I may mention the following names which are now well known in the world of sciences, art, literature, politics and, of course, in the military and naval history of France: Monge, Berthollet, Lagrange, Laplace, Prony, Parmentier, de Jussieu, Cuvier, Montgolfier, Colin d'Harleville, Chénier, Fontanes, Le Brun, Dacier, Sylvestre de Sacy, David, Le Sueur, Méhul, Monsigny, Cambacérès, Siéyès, Talleyrand, Fouché, Volney, d'Aguesseau, Portalis, Brillat-Savarin; all the *Maréchaux de France*, the *Generals* and *Admirals;* it may be mentioned here that Marshal Augereau refused to answer when his name was called.

A second distribution of a still more solemn character was made by the emperor, at Boulogne-sur-Mer, on 17 April 1805, in presence of 70,000 troops. Presently the Cross of the Legion of Honor was to smell powder for the first time at the famous battle of Austerlitz (2 Dec. 1805). According to the latest statistics there are 49,236 *légionnaires*, distributed among the five degrees as follows: *Chevaliers*, 41,108; *officiers*, 6,713; *commandeurs*, 1,142; *grands officiers*, 229; *grands-croix*, 44—total, 49,236.

The President of the Republic is the "*souverain chef et grand maître de l'Ordre*" (sovereign head and grand master of the order).

These statistics, however, were compiled before the war; none of a more recent date are available, although more than 30,000 crosses have been allowed since the beginning of the war; a decree of 13 Aug. 1914 authorizes the distribution of as many crosses as circumstances will require; but a special law passed by both Houses of Parliament will be necessary to give a legal and definite ratification to all the nominations. Of course the bill will be passed without the slightest opposition. During peacetime, in order to be admitted to the membership of the Legion of Honor it is necessary to have discharged, with some distinction, civil or military functions during at least 20 years and sometimes 25 years. This rule, however, does not apply to the persons who have rendered extraordinary services in their civil or military functions, or in the arts and sciences. But, in any case, in order to be admitted to a superior grade it is necessary to have been: (1) For the grade of *officier*, four years a *chevalier;* (2) for the grade of *commandeur*, two years an *officier;* (3) for the grade of *grand officier*, three years a *commandeur;* (4) for the grade of *grand-croix*, five years a *grand officier*.

The nominations and promotions from a lower to a superior grade are made twice a year, on the 1st of January and the 14th of July. There are of course exceptions to that rule when the latter are justified by extraordinary services and circumstances, as for instance in time of war, but the Legion of Honor is the highest distinction of that kind which can be obtained in France; it is not granted easily, and there is no *légionnaire* who is not very proud to wear the badge of an order which has been famous ever since it was created by Bonaparte.

All officers, non-commissioned officers and privates in the army and the navy who are members of the Legion of Honor receive the following annual pensions according to their grade: *Chevaliers*, 250 francs ($50); *officiers*, 500 francs ($100); *commandeurs*, 1,000 francs; *grands-officiers*, 2,000 francs; *grands-croix*, 3,000 francs.

No pension whatever is paid to the *légionnaires* who have been admitted to the membership of the order for *civil* services.

When admitted or promoted, the *légionnaires* have to pay to the *Grande Chancellerie* the following fees according to their grade:

	For the copy of the patent	For the price of the badge
The Chevaliers............	25.00 francs	12.00 francs
" Officiers..............	50.00 "	67.50 "
" Commandeurs........	80.00 "	149.00 "
" Grands Officiers.......	120.00 "	58.00 "
" Grands Croix.........	200.00 "	240.00 "

The administration is entrusted to a Grand Chancellor who holds the seal of the Order, works up the annual budget, reports to the President of the republic all propositions concerning the Legion of Honor, etc. A Secretary-General, appointed by the President of the republic, represents the Grand Chancellor when the latter is absent for any reason whatever.

The Grand Chancellor is assisted by a Council of the Order which assembles every month for general purposes (management, budget, control of the regulations, vacancies arising from the death of members every six months), distribution of the available crosses among the different ministerial departments, discipline, etc. The Council consists of the Grand-Chancellor, president; the Secretary-General, vice-president, and 12 members of the Order appointed by the President of the republic.

Membership in the Legion is forfeited whenever the *légionnaire* loses temporarily or permanently his rights of French citizenship. The President of the republic is also empowered to suspend or suppress the use of the rights and prerogatives attached to membership of the Order, after a penal sentence of a civil or military court, and whenever it has been ascertained that the *légionnaire* has acted in a dishonorable manner in certain cases where the law provides no penalty.

Of course, distinguished foreigners are admitted to the Order, but their admission is at the same time more easy and more difficult than is the case for Frenchmen; more easy because there are no restrictions as regards the length of time during which they have to make themselves serviceable, and more difficult because the cross is allowed only on account of rather high distinction. A law provides that foreigners are "*admis et non reçus*" (admitted, not received), and form a contingent quite distinct from the French *cadres*. The foreign members of the Order have the same rights as the French members to a funeral with military honors.

Among the Americans who are or have been members of the Legion of Honor may be mentioned the following:

GRANDS CROIX.

Horace Porter (soldier and diplomat)
Robert S. McCormick (diplomat)

GRANDS OFFICIERS.

David R. Francis, ex-Secretary of the Interior
Francis B. Loomis (diplomat)
Rear-Admiral Peary
Ferdinand W. Peck
Charlemagne Tower (diplomat)
Major-General Leonard Wood

COMMANDEURS.

Rear-Admiral Ammen
Brigadier-General Baird
Wharton Barker (University of Pennsylvania)
Major-General John R. Brooke
Nicholas Murray Butler (president Columbia University)
Andrew Carnegie (steel magnate and philanthropist)
Rear-Admiral Higginson
Major-General Howard
Mgr. John Ireland (late archbishop of Saint Paul)
Perry Belmont (diplomat)
Dr. Arthur W. de Roaldes (surgeon)
Major-General Schofield
Major-General Sickles

OFFICIERS.

Charles F. Beach (a distinguished American lawyer practising in Paris)
Paul Wayland Bartlett (sculptor)
A. Barton Hepburn (ex-president New York Chamber of Commerce)
Patrick Collins (late mayor of Boston)
Deering Jones (Chicago)
Charles W. Eliot (president emeritus, Harvard University)
James Howard Gore (professor of Columbia University)
William R. Harper (late president of the University of Chicago)
William Jacob Holland (director of the Carnegie Institute, Pittsburgh)
James H. Hyde (formerly vice-president of the Equitable Insurance Co.)
Harry Pratt Judson (president of the University of Chicago)
A. Lawrence Lowell (president of Harvard University)
C. W. McCormick (president of the McCormick Harvesting Co.)
John W. Mackay (president of the Commercial Cable Co.)
Ridgway Knight (artist)
Robert J. Thompson (diplomat)
Edward Tuck (banker)
John Wanamaker (formerly Postmaster-General)

Two weeks after the famous battle of Austerlitz a decree signed by Napoleon, at Schoenbrunn, on 15 Dec. 1805, ordered the creation of three schools for the education of the daughters of the members of the Legion of Honor. The first of these schools was established in the *Château d'Ecouen*, near Versailles, in 1806; the second one, at Saint-Denis, near Paris, in 1808, the third one, at *La Maison des Loges*, in the forest of Saint Germain, in 1811.

The daughters of the *légionnaires* who have no fortune are admitted free of charge to these educational establishments; the granddaughters, sisters or nieces of the *légionnaires* are also admitted to the same establishments, but they have to pay 1,000 francs a year at the Saint-Denis school and 700 francs at the *Ecouen* and *des Loges* schools. The total number of pupils admitted free of charge in the three schools amounts to 1,200, whilst the number of paying pupils is limited to 155 altogether. The *Grand-Chancellier* has the general control of the three establishments to which the pupils are admitted on his own recommendation to the President of the republic.

The annual expenses of the Order are about 17,000,000 francs ($3,400,000), the two principal items being the pensions of the members, about 10,000,000 francs ($2,000,000), and the pensions of the *Médailles Militaires*, about 6,000,000 francs ($1,200,000), (see MÉDAILLE MILITAIRE below), other minor items of expense being the salary of the staff at the *Grande Chancellerie* about 250,000 francs ($50,000), the three educational establishments for young ladies about 300,000 francs ($60,000). The receipts are provided by an annual interest of 4,150,000 francs ($830,000) on *Rentes françaises* (French Consolidated Fund), which are owned by the Order. The *Domaine d'Ecouen* together with the fees paid by some of the pupils give an annual income of about 110,000 francs ($22,000). The Ministry of Justice, to which the Order of the Legion of Honor is financially connected, provides every year all the funds required to balance the accounts. It may be mentioned here that in 1916 a rich American gentleman, formerly a president of the National City Bank, New York, contributed generously 1,000,000 francs ($200,000) to the Order, the interests of which are to be distributed among the children of the *légionnaires* who have been killed during the war.

The *Palais de la Légion d'Honneur* which is situated on the *Quai d'Orsay* and *Rue de Lille*, is the private property of the Order. It was burnt down during the Commune in 1871, and part of the records were destroyed. On the initiative of General Vinoy, who was then the Grand-Chancellier, a public subscription for the reconstruction of the building was opened on 7 June 1871. The list was headed by Monsieur Thiers with 2,000 francs; on 2 October the subscription lists were closed. A total amount of 1,625,599 francs 19 centimes ($325,119.83) was provided, mostly by the *légionnaires*. The *Palais* was completely reconstructed in 1878.

The Legion of Honor may be granted to privates and non-commissioned officers, but in very exceptional circumstances only. The *Médaille Militaire* (which carries the privilege of an annuity amounting to 100 francs ($20)), was therefore created in 1852 in order to recognize the services of "non-commissioned officers, corporals, privates or marines," especially in time of war. The *Médaille Militaire* may also be granted to field-marshals and admirals and to general officers who have been commanders-in-chief. In such cases, that distinction is considered as being second to none. The *Médaille Militaire* for instance was granted to Marshal Joffre after the battle of the Marne.

Military Medal.

The *médailles* are granted partly on the recommendation of the Minister of War and the Minister of the Navy, and partly on the recommendation of the *Grand-Chancellier de la Légion d'Honneur;* but all nominations are to be approved by the *Conseil de l'Ordre.* As already stated, the pensions of the *Médaillés Militaires* absorb about 6,000,000 francs of the financial resources of the Legion of Honor.

MARC DE VALETTE.

LEGISLATION. The term «legislation» in its most restricted sense has reference to the enactments of a legislative body (see LEGISLATURE). In a larger sense, legislation embraces the totality of general rules of law binding upon the community, whether they emanate from a legislative body, from the people acting by way of the referendum, from a constituent assembly (in the United States a «constitutional convention»), the chief of state (president, king or emperor), or a subsidiary law-making body, such as a municipal or county council. In a special sense it may also be applied to the body of so-called judge-made law built up by the courts as a result of their power to interpret the meaning of the constitution and laws. Legislation through the agency of bodies of specially chosen representatives is of modern origin. (See LEGISLATURE). Among the ancients custom was the chief source of law, and in Rome positive written law had to conform to custom in order to be valid. This theory of the supremacy of customary law over written law persisted throughout most of the mediæval period. (See LAW). After the close of the Middle Ages, however, legislation was exalted above custom, the idea that legislation proceeded from the state took root and it was denied by the jurists that customary law might override the prescriptions of positive law.

In the United States the great body of legislation consists of the enactments of Congress, the State legislatures and the various subsidiary law-making bodies, particularly the municipal councils. The constitutions also contain a large body of legislation, and not all of this is organic or fundamental in character, for in recent years there has been a marked tendency to insert in them many rules of private law and even rules of parliamentary procedure. (See CONSTITUTION). Formerly much of this legislation was embodied in the statutes, but the growing distrust of the legislatures has had the effect of transforming more and more the constitutional convention into an ordinary law-making body as well as a constituent assembly.

The evidence of this tendency is found in the great length of some of the more recent constitutions, such as those of Louisiana, Oklahoma and Virginia, all of which contain a multitude of provisions which logically should be reserved to the statutes. The body of legislation found in the constitutions and the statutes is supplemented by a mass of judge-made law consisting of the interpretative decisions of the courts. Not strictly legislation in form, it is such in effect, and a study of the text of a constitution or statute apart from the constructions which have been read into it by the judiciary often gives an imperfect knowledge of its meaning and effect. Where there is doubt as to the meaning of the statute the courts not only claim the right to discover its meaning, but also to give effect to the intention of the law-maker so far as that intent can be ascertained. «Modern courts,» says, the German jurist Windschied, «may and habitually do think over again the thought which the legislator was trying to express,» while the Roman jurists went even further and undertook «to think out the thought which the legislator was trying to think,» that is, what he would have intended had he known what future conditions would be. English and American judges, however, have always maintained that they do not legislate, that they do not «make» the law in interpreting the meaning of doubtful statutes, but that they only «find» it, between the lines as it were. Finally, in addition to the body of legislative enactments and judge-made law there is a mass of what is in effect, though not in form, legislation emanating from the executive as a result of the power to issue orders and regulations. Though far less in quantity and importance than the body of executive legislation in Europe, where the ordinance power of the executive is much larger, it is nevertheless very considerable, and of far more importance than is generally known in this country. Thus the President of the United States, in pursuance of authority either delegated to him by Congress or resulting from his constitutional power to execute the laws, has issued regulations for the government of the army and navy, the operation of the postal service, the management of the public domain, the conduct of the Indian service, the civil service, the customs service, the internal revenue service and various other branches of the administrative service. Many of these regulations lay down rules of conduct not only for public officials and employees, but are binding upon private individuals as well and for violation of which they are subject to the penalties of the criminal law. See EXECUTIVE.

In Europe this source of legislation is even more important, for there the ordinance power of the executive is much larger. In England what are known as the «statutory rules and orders in council» constitute a very extensive and important body of subsidiary legislation; they are published with the acts of Parliament and not infrequently constitute the larger bulk of legislation found within the covers of the volume of law enacted annually for the government of the English people. They consist of orders issued by the Crown in Council either in pursuance of the royal prerogative — a more or less undefined realm of power which the Crown inherited from early times and of which it has never been deprived by Parliament — or in pursuance of authority, expressly delegated to the Crown or the ministers by act of Parliament. Some of these orders are issued for the purpose of supplementing the statutes, which in England are usually brief and embody in outline only the general will of Parliament; others regulate matters with which Parliament has not dealt at all, but the regulation of which has been delegated to the Crown or the minister.

On the continent of Europe legislation of this character is even more extensive. There the power of the executive to issue ordinances (*réglements, Verordnungen*) and regulations (*arrètés*) is very large. There even more than in England acts of the legislature rarely descend into details in laying down rules of conduct or in prescribing the mode of executing the law. Usually the will of the legislature is declared only in general terms and a large discretionary power is left to the officer charged with the execution of the law. The power to elaborate the statute and supply the details so as to make it enforceable is then left to the executive through the exercise of the *pouvoir réglementaire*. There also much more than in the United States a large independent power of legislation in respect to matters not dealt with by the legislature is delegated by Parliament to the executive. Thus in France the power to legislate for the colonial possessions in so far as the Parliament itself has not legislated on colonial matters is exercised by the President of the republic.

Regarding the procedure and methods of legislation by legislative bodies a few observations may be made.

It is a general though not an absolutely universal constitutional rule that revenue bills may originate only in the more popular of the two chambers. The rule originated at a time when upper chambers were generally appointed or were largely hereditary bodies and it was, therefore, considered improper to permit them, being irresponsible as they were to the people, to initiate measures for laying taxes. Although in many countries the upper chamber is now a popularly elected body, the old restriction on its power to initiate money bills still survives in spite of the fact that it no longer has any *raison d'être*. In a number of countries, notably France and the United States, the exact meaning of the restriction has often been a source of controversy between the two chambers. In countries like the United States, where the so-called presidential system of government prevails, legislative measures may be initiated only by members of one or the other chamber; on the contrary, in those countries where the cabinet or parliamentary system is found, it is the right of the ministry as well as of any member to introduce bills and in practice most important measures are prepared and introduced by the ministry. They are, therefore, known as «government» bills in contradistinction to «private» bills, or those introduced by members who do not belong to the ministry. Their passage is advocated by the ministry and the refusal of the legislature to pass them may and generally does cause the ministry to resign. (See CABINET GOVERNMENT). Indeed, in England, Parliament has to a large degree abdicated its legislative power in favor of the Cabinet. In practice it chooses from its members a small body of leaders to whom it accords the power to frame legislative measures, reserving to itself only the right of control.

In the United States and England a distinction is made between bills and resolutions. A bill embodies the will of the legislature on matters of a more permanent and fundamental character, while a resolution embodies the legislative will on matters of a temporary or subsidiary character. In Congress and some of the State legislatures a distinction is also made between joint and concurrent resolutions, the latter of which expressing the views of the legislature only do not require the approval of the executive. In Congress and in many of the State legislatures joint resolutions like bills must be submitted to the executive for his approval or disapproval.

In England and the United States an important distinction is that between public and private or local bills. A private bill, unlike a public bill, instead of dealing with matters of public interest and affecting generally all persons within the State or all persons within a particular class as defined according to some essential characteristic, affects only a particular person or locality. Such are bills for the incorporation of a city or a public service company, for changing the name of an individual, for legitimizing an illegitimate child, for the settlement of a private claim and the like. It is characteristic of such bills that they are generally designed to confer a benefit, a privilege or an exemption upon some person, company or place. In the English Parliament a special procedure has been provided for dealing with such bills. They may be brought before Parliament only by petition and only after public notice has been given by advertisement in the community to be affected by the bill if it becomes a law. Fees are also required of the parties promoting or opposing such bills. After being reported on by two examiners of petitions they are considered by a special committee on private bills which after hearing evidence for and against them makes a recommendation to the House. In the United States generally the procedure in respect to private bills does not differ in essential particulars from that in regard to public bills. In a few States, however, there is a different procedure. Thus in Massachusetts private or local bills may be proposed only by petition and due notice must be given to all the parties concerned. In some States prior notice of an intention to apply for a special act must be published in the community where the person or thing affected is found. In New York local and private bills providing for an appropriation of money require a vote of two-thirds of the members of the legislature for their enactment while bills affecting a single city must after passage by the legislature be submitted to the mayor thereof for his approval. Legislative bodies usually have the power to provide for their own organization and to frame their own rules of procedure. By the Constitution of the United States, however, the Vice-President is made the presiding officer of the Senate and by most of the State constitutions the lieutenant-governor is made the presiding officer of the State senate. The State constitutions likewise impose certain restrictions on the legislature in respect to its procedure. Thus both houses are required to keep and publish a journal of their daily proceedings; generally it is provided that no law shall be passed except by bill; that no bill shall embrace more than one subject which shall be clearly expressed in the title; that every bill shall be read at least three times before being passed; that no law shall be amended by mere reference to its title, but the amended portion must be set out in full; that the yeas and nays of members voting shall be recorded upon the demand of a certain number of members; that every bill shall be referred to a committee for examination and report; and that all bills shall be printed and placed on the desks of members, etc. Subject to these and sometimes other similar constitutional requirements the legislature is free to adopt such rules of procedure as it may choose. See also CABINET GOVERNMENT; CONSTITUTION; EXECUTIVE; LAW; LEGISLATURE.

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LEGISLATION, Direct. As its name implies direct legislation is a system of law-making in which the people themselves legislate instead of delegating that duty to a group of elected representatives known as a legislature. It has come to be synonymous with the initiative and referendum although it may properly be regarded as a more general and inclusive term. See INITIATIVE and REFERENDUM.

History.— While direct legislation seems first to have made its appearance in Switzerland in the 16th century it is in the United States that its evolution and operation may best be studied. The germ of the modern system of direct legislation may be found in the colonial custom of authorizing the constituency of a member of the legislature to «instruct» him formally as to their wishes in relation to any problem of legislative policy. This «instruction» did not legally bind the legislator but merely imposed a possible moral obligation upon him. A second step in the direction of direct legislation was the establishment in Massachusetts in 1778 of the precedent of referring a new State constitution to the people for ratification. The spread of this system has been rapid and consistent and it may now be regarded as settled that American State constitutions may be neither adopted nor amended without the approval of the electorate of the State. In the third place, some of the earlier State constitutions required that upon certain specific questions any action taken by the legislature must receive popular ratification at the polls. The subjects upon which such referenda were necessary were not numerous and the favorites seem to have been the State banking laws, bond issues and the location of State capitols. Finally, the principle of direct legislation was applied to local problems. Where absolute uniformity of legislative policy throughout the entire State seemed undesirable «local option» was introduced whereby separate localities could adopt or reject a certain policy as their needs and desires might direct. This system of «local option» was frequently employed to solve the vexed problem of the regulation of the liquor traffic but it has also been applied to local financial problems, boundary changes and in more recent times under the name, «municipal home rule,» to the very structure of municipal government.

In 1898 South Dakota adopted a constitutional amendment creating a system of State-wide initiative and referendum. This was the first State to place the power to enact and to veto laws directly in the hands of the people. In 1902 Oregon followed suit with a system of direct legislation which has attracted wide attention and has served as a model for several of the American States. The spread of the system since that time has been fairly rapid, especially in the States west of the Mississippi River. By January 1919 21 States have the initiative or referendum or both, the State of Massachusetts adopting the system of direct legislation in November 1918. For the names of these States together with the dates of the adoption of the system, see under INITIATIVE and REFERENDUM.

Public Opinion Bills.— It is well established that the legislature cannot delegate its law-making power to the electorate without being specifically authorized to do so by the State constitution. In other words any system of direct legislation must be provided for in the organic law of the State. Several of the State constitutions, however, definitely authorize the legislature to consult the wishes of the people upon legislative measures whenever they desire to do so and with the understanding that this expression of popular opinion is merely advisory. In Illinois this system has been still further developed in the Public Opinion Act of 1901 which permits 10 per cent of the voters of the State by petition to secure the reference of any proposition to a vote of the people for an expression of opinion.

The vote thus taken does not bind the legislature but gives them an accurate knowledge of what the people desire.

Voters' Interest in Direct Legislation.— Election statistics show that in general people are less interested in voting upon constitutional amendments and statutes than upon candidates for office. The percentage of interest thus shown varies from year to year, from State to State, and from measure to measure. Roughly speaking, the number of people who will vote in a direct legislation election seems to range from 60 to 80 per cent of those who will vote for State officers. Some questions like prohibition and woman suffrage always called forth a heavy vote while other less striking measures sometimes come very near escaping the voter's eye altogether. Some States try to guarantee that only measures which are of general and State-wide interest be submitted to the people by requiring not only that a certain per cent of the voters must petition for their submission but also that that per cent must be obtained in two-fifths, or half as the case may be, of the counties of the State. Thus measures of purely local concern are automatically excluded from the ballot.

Advantages.— The arguments in favor of direct legislation may be summarized as follows: First, it embodies the central principle of democracy for it places in the hands of the people the means of securing without interference or delay the enactment of their will into law. Second, the realization that it is futile to oppose the wishes of an electorate possessing the power of direct legislation will make the legislature more sensitive to the popular will and render the frequent use of the initiative and referendum unnecessary. Third, the educational value of direct legislation cannot be over-emphasized. From his share in it the voter acquires interest and information regarding public affairs which increase his value as a citizen. Finally, the system has proved successful in practice. The States which have it show no disposition to abandon it, the laws which the people have enacted have been well drawn and salutary, and civic interest has been augmented.

Disadvantages.— The opponents of direct legislation advance the following arguments: First, it destroys representative government by weakening not only the power of the representative legislature but also its sense of responsibility. Second, it tends to break down the fundamental distinction between the constitution of the State and ordinary statutes by making it possible for them both to originate and be changed in substantially the same way. Thus respect for the constitution is diminished. Third, it imposes upon the voter the burden of expressing an opinion upon questions regarding which he has little or no information or understanding. Fourth, in like manner it burdens the voter with the decision of problems in which, as proved by the actual votes cast in many instances, he has little or no interest. Fifth, it turns the technical and difficult task of drafting laws over to amateurs with the result that much of this legislation is carelessly drawn and defective. Sixth, it has accomplished nothing where it is in use which has not been done with less expense and trouble elsewhere. Finally, it opens up vast opportunities for demagogues and radical minorities to persist in the presentation of their fads and programs until by virtue of the sheer weariness and indifference of the electorate they may secure their enactment into law.

Recall.— While the recall of officers is hardly an integral part of a system of direct legislation it is very frequently a companion of the initiative and referendum. It embodies the principle of direct political action by the people. It permits a stipulated percentage of the voters by petition to compel an officer to stand again for re-election before the expiration of his term. If he does not receive a majority of the votes cast in this election he is thereby ousted from office and the opposing candidate assumes the duties of the office. The recall is regarded as a more radical system than the initiative and referendum, is in force in fewer States and is less frequently used where it is in force. See RECALL.

For literature on direct legislation see INITIATIVE and REFERENDUM.

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LEGISLATIVE REFORM. Growth of Popular Distrust of Legislatures.— No one can say that American State legislatures have been denied the opportunity to prove themselves worthy of the confidence and respect of the American people. At the close of the Revolutionary War a reaction in political opinion set in which reduced the formerly powerful State governor to the position of a figurehead and enormously expanded the importance and authority of the legislatures. The use made by the State legislature of these wide powers, especially during the ante-bellum decades when corporate charters, franchises and other special privileges were being granted, forms one of the black chapters in our political history. While corruption and disregard of the public interest were not universal they were so nearly so that American public opinion came to regard the State legislature with a distrust which recent efforts at reform have not succeeded in removing. This popular distrust of State legislatures has been evidenced in the constitutional provisions, which began to appear about the time of the Civil War, placing restrictions upon legislative powers. Some of these related in minute detail to legislative procedure but mostly they comprised long lists of subjects upon which the legislature might not act at all or might act only under rigorous constitutional restraints. This distrust was also shown in the very general policy of providing that legislatures should meet only every other year and that the length of the session should be restricted, provisions reflecting clearly the point of view that a legislature is a necessary evil and its term of activity should accordingly be reduced to the minimum. The recent spread of the system of direct legislation, whereby the people acquire the power themselves to enact or veto laws, is a further indication of popular lack of confidence in our representative legislatures.

Present Need for Legislative Reform.— The more striking criticisms which at the present time may legitimately be urged against State legislatures may be summarized as follows: First, the quality of the men who compose them is frequently exceedingly poor. Without losing sight of the fact that many, probably most, of the legislators are honest and some of them are competent, it remains true that too frequently they prove to be venal and wholly unfit by training or education to perform the functions of their office. Second, lobbying continues to prevail at most State capitols. Corporations and organizations desirous of securing special privileges at the hands of the legislature send paid representatives to exert influence upon the members. While this influence may be exerted by legitimate means, such as arguments before legislative committees, it is far more likely to take the form of open bribery or other forms of corruption. Third, the demand for special and local legislation, what may be called private legislation, leads to most serious abuses. The time of the legislature is occupied with matters trivial in importance while the demands of various localities and interests for legislative consideration are met by the convenient method of "log-rolling," or "pork-barrel" legislation, whereby each legislator in order to secure the granting of his own demand supports those of every one else. Local and individual interests are thus furthered; the interests of the State at large are ignored. Fourth, legislative procedure is complicated and beset by technical requirements which too often result merely in confusion and delay without securing the deliberation and caution which they were designed to provide. The result is hasty and ill-considered legislation turned out in enormous quantities. Fifth, there is no centralized responsibility for legislation passed by a State legislature. Such responsibility is lost in a maze of committees and party caucuses as well as between the two houses of the legislature. No men or group of men can be held really accountable for objectionable legislation. Finally, the laws themselves, drawn by men from every walk of life, most of whom are without training or experience, are frequently poorly drawn. No effort is made to relate them to the already existing law of the State, while they frequently do not accomplish their obvious purposes because of ambiguous or conflicting provisions.

Proposals for Legislative Reform.— The need for reform in our State legislatures has long been recognized and a variety of remedies have been suggested and in some cases adopted. These proposals may be considered briefly as follows: (1) The first is a sweeping change in the structure, composition and organization of the legislature. The bicameral or two-house system is to be abolished and the size of the single house much reduced. This, it is claimed, would minimize confusion and encourage efficiency. This single house is to be elected by a system of proportional representation so that the various political and economic interests may have adequate representation therein. Finally greater harmony is to be established between the legislature and the executive of the State by allowing the governor and heads of the administrative departments to have seats in the legislature. This program was devised by reformers in the State of Oregon but has never been adopted in any State. (2) A second and less revolutionary measure of reform is directed against the abuse of lobbying. Two schemes have been devised for this purpose: One of them, embodied in a New York statute, requires the registration in the office of the secretary of state of all lobbyists together with the names of the persons or interests they represent and an account of any money spent in influencing legislation. The other plan is in force in Wisconsin and forbids entirely all efforts to influence members of the legislature privately. Lobbyists must confine themselves to appearance before legislative committees and the presentation of printed literature to individual legislators. Both of these laws have produced salutary results. (3) A third remedy for legislative abuses is the introduction of a budget plan for the control of State finances. By placing in the hands of a responsible State officer the duty of presenting a financial program which shall comprise the estimates both of income and expenditures and by taking from the legislature the power to increase the appropriations thus proposed the serious evils of the "pork barrel" will be removed and the energies of the legislators will be released for the consideration of matters of State-wide importance. (4) In the fourth place legislative procedure must be reformed in such a way as to secure adequate and careful consideration of all measures. (5) Fifth, the length of legislative sessions should be extended so as to permit a more efficient and leisurely transaction of public business. Good laws can hardly be expected from a legislature which must complete its work in 60 days. (6) Sixth, legislative salaries should be increased to a point which would make it possible for the abler and better trained citizens to become legislators without too serious financial loss. A State which pays but $4 a day to its lawmakers cannot justly complain if their work is not of highest grade. (7) In the seventh place, several States, following the lead of New York and Wisconsin, have established legislative reference bureaus. To be most efficient such bureaus should not only collect data upon problems of legislative policy for the benefit of the members of the legislature but it should also be able to offer expert help in the difficult task of bill-drafting. These bureaus have materially raised the quality of legislation in the States where they exist. (8) Finally, real and permanent legislative reform cannot be expected unless the people of the State take an interest in the work of the legislature, keep informed and alert in regard to matters of legislative policy and show a willingness to let the legislators know their opinions and desires. Bad government cannot exist for long where public sentiment is intelligent and aroused.

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LEGISLATURE. In the most general sense of the term a legislature is any law-making body, whether Congress, Parliament, Landtag or other assembly of representatives charged with the enactment of general rules of conduct binding upon the inhabitants of the state. In a narrower sense the term is descriptive only of the law-making bodies of the States composing the American republic, although several of these bodies are officially designated by other names. Thus in several States the legislature is officially known as the general assembly or the legislative assembly, and in two, Massachusetts and New Hampshire, the Colonial name «general court» survives.

Legislatures are of modern origin. Among the ancient Greeks legislation was enacted by popular assemblies rather than by select bodies of representatives. Among the ancient Romans legislation was enacted by the *comitia*, likewise a popular assembly embracing all the citizens of Rome. Under the empire the emperor became the chief source of legislation and his edicts and rescripts were supplemented by a large body of judge-made law emanating from the prætors and jurists. Representative law-making bodies in the modern sense never existed among the Romans. Montesquieu was right when he said that the ancients had no notion of a legislative body composed of representatives of the people ('Esprit des lois,' Bk. xi, ch. 8). The English historian Freeman remarks that «the ancient world trampled on the very verge of representative government without actually crossing the boundary» ('History of Federal Government,' ch. 2). Throughout the Middle Ages the chief source of legislation was the king or the feudal lord. The beginnings of the modern representative system are found in the *Witenagemot* of early English history, out of which the English Parliament, the first representative legislature known to history, was destined ultimately to evolve. Not popularly elected at first, its members came eventually to be chosen by the freeholders. In the 13th century, thanks to Simon de Montfort, representatives of the boroughs were added. From early times the clergy also had their representatives, so that in the end the Parliament, as it came to be called, was indeed an assembly of the three estates of the realm: nobility, commons and clergy.

On the continent of Europe the development of legislative bodies was slower of growth. The rise of cities gave an impetus to the development of the representative principle through the demand which it created for representation of these agglomerations in the law-making bodies. In France the beginnings of legislative representation are found in the meeting of the representatives of the three estates in a general parliament in 1302. Called together to consult with the king, they soon acquired the right to give or withhold supplies from the Crown. Meetings of the estates took place at regular intervals until 1614 when they ceased to be convoked by the king until the outbreak of the Revolution. From that time on France has had a Parliament, although it has not always been a truly representative body, during the period of 1800–14.

It was characteristic of the representative system of Europe until the 18th century that its legislative bodies did not represent the whole people but special classes such as the clergy, the nobility, the towns and the like. The deputies of each class were separately summoned and often sat apart and voted separately. Thus the Parliament of Sweden until comparatively recent times was composed of four chambers. Deputies usually also bore instructions from their constituencies and were obliged to vote in conformity with the mandates thus given. They were, therefore, not representatives in the modern sense, with power to declare the will of the people, but only delegates commissioned to consult for the common good and to report back to their constituencies.

Ultimately nearly all the legislative bodies of Europe came to consist of two chambers. In England this transformation was completed early in the 14th century, the representatives of the nobility and clergy constituting one chamber; the representatives of the towns, boroughs and counties, the other. It was due wholly to the existence of this class system in England rather than to any considerations of policy or expediency that the organization of the British Parliament came to be bicameral in structure. Inasmuch as the distinction between clergy, nobility and commons was never introduced into America the reason which gave rise to the bicameral system in England never existed here. Nevertheless, all of the original State legislatures, except those of Georgia, Pennsylvania and Vermont, were constructed on the bicameral principle. Benjamin Franklin stood almost alone among the founders of the republic in advocating the unicameral system of legislative organization, and it was mainly due to his influence that the legislature of Pennsylvania at first consisted of a single chamber. The three States which started with single-chambered legislatures, however, soon abandoned the system for the bicameral idea and it has prevailed in all the States then existing and in those subsequently admitted to the Union. Likewise Spain, Portugal, Mexico, Bolivia, Ecuador, Peru and other states which once had unicameral legislative bodies have all abandoned the single chamber principle for the bicameral system. «The bicameral system,» says Francis Lieber, «accompanies the Anglican race like the common law and everywhere it succeeds.» «Of all forms of government that are possible among mankind,» said the historian Lecky, «I do not know any which is likely to be worse than government of a single omnipotent democratic chamber.»

The superiority of the double-chambered legislature is defended on several grounds. In the first place, the existence of a second house serves as a check on hasty and ill-considered legislation. In the second place, the bicameral system affords protection to the people against the despotic tendencies of a single chamber — «it doubles the security of the people,» said Judge Story, «by requiring the concurrence of two distinct bodies in any scheme of usurpation or perfidy where otherwise the ambition of a single body would be sufficient.» The Americans restrain their legislatures, says James Bryce, by dividing them just as the Romans restrained their executives by substituting two consuls for one king. On the other hand, there has been a growing disposition in recent years to question some of the advantages claimed for the bicameral system, and in a number of States, notably Oregon, Nebraska and California, there have been well-organized movements looking toward the establishment of legislatures composed of a single house. In Oregon the question of abolishing the senate was submitted to a vote of the people in 1912 and again in 1914, and although the proposal was defeated a large vote was cast in favor of it. In Nebraska a joint committee of the legislature after making a careful study of the merits and demerits of the bicameral system made a report advocating the establishment of a small legislative body composed of a single chamber. Likewise in California recently a majority of both houses of the legislature voted in favor of a proposed amendment to the constitution providing for the creation of a single-chambered legislative assembly. The arguments against the bicameral system are in brief the following: It greatly increases the cost of legislation by reason of the larger number of members and employees; it conduces to deadlocks, dissension and intrigue; and it retards the dispatch of legislative business. Moreover the checking function, which is the chief *raison d'être* for a second chamber, works both ways; that is, it often serves to hinder the enactment of good legislation as well as to prevent bad legislation. Again, since both houses are now elected by constituencies composed of the same persons, each house is little more than a duplicate of the other; neither is more radical or more conservative than the other and hence neither is by its constitution and nature disposed to restrain the other. Advocates of the single-chambered system also argue that the executive veto, the referendum and the power of the courts to declare acts of the legislature unconstitutional now afford adequate checks against unwise and unconstitutional legislation. Finally, it may be remarked that there are already more than 60 single-chambered legislatures in the world to-day, including those of Greece, Bulgaria, Serbia, the South African Union, all the provinces of Canada except Quebec and Nova Scotia and many of the German states. As is well known the legislative bodies of many large cities are also unicameral in structure. The unicameral principle, therefore, is not a theory but it is in practical operation in many countries.

In many of the European states the upper houses of the legislature are not organized on the principle of popular representation. In some of them there is a hereditary element, in others certain public officials are members of right and in many there is an appointive element. (See GREAT BRITAIN — PARLIAMENT). In the United States since the adoption of the 17th amendment the upper house of Congress has been chosen by the same method as the lower house so that both rest on the same principle although senators are chosen for longer terms, they represent larger constituencies and higher qualifications are required of them. Both houses of the State legislatures are composed of representatives with only slightly different qualifications and terms, and they are chosen by constituencies made up of the same class of electors. Members of both houses are apportioned either on the basis of the total population or the number of voters. Equality of representation is everywhere proclaimed as a principle, but the principle is seriously deviated from in certain New England States where in consquence of the town system of representation small communities with populations of less than 1,000 inhabitants not infrequently choose as many representatives as populous cities like Providence, New Haven and Hartford. The common rule that each county, however small its population, shall have at least one representative or that each county shall have one senator often plays havoc with the principle of equality of representation. In several States constitutional limitations have been imposed on the representation of the large cities. Thus in New York, no county may have more than one-third of all the representatives — a provision designed to limit the representation of New York city; and somewhat similar provisions are found in the constitutions of Pennsylvania and Rhode Island.

Illinois alone among the States has a system of minority representation in the lower house of the legislature. Under this system, introduced in 1870, it has nearly always been possible for the principal minority party in each legislative district to choose one of the three members to which the district is entitled in the lower house, and it has often enabled secondary parties such as the Prohibitionists, Progressives and Socialists to elect a few members. (See PROPORTIONAL REPRESENTATION). It has the disadvantage, however, of frequently resulting in the election of a house in which no party has a working majority, thus making difficult the enactment of important constructive legislation. Moreover, it frequently results in the election of a legislature, a majority of the members of which belong to a political party different from that to which the governor who is chosen at the same election belongs, thus dividing the legislative power between two politically antagonistic departments and thereby paralyzing it to a degree.

In all the States the upper house of the legislature is officially designated as the senate. In size the State senates vary from 19 members in Arizona to 63 in Minnesota, 40 or 50 being a common number. In about two-thirds of the States the terms of senators are four years; in most of the others it is two years; in New Jersey it is three years; and in Massachusetts and Rhode Island it is one year. In a number of States the senators are divided into classes, the terms of one-half or one-third of them expiring at the same time, thus making the senate to some extent a permanent and continuous body. In all the States the senate has certain special functions such as the approval of executive appointments and the trial of impeachment cases.

In most of the States the lower branch of the legislature is known as the «house of representatives,» in a few it is styled the «assembly,» and in three the «house of delegates.» In size it varies from 35 members in Arizona to more than 400 members in New Hampshire, the houses of the New England legislatures being especially large on account of the town system of representation. Their senates, however, are small bodies: 24 in New Hampshire, 35 in Connecticut, 30 in Vermont and 40 in Massachusetts.

In all the States members of the legislature receive some pecuniary compensation for their services. It is in the form either of a salary or a *per diem* allowance. The largest salaries are those paid the members of the legislatures of Illinois and New York ($3,500 per term and $1,500 per year, respectively); the smallest are those of South Carolina and New Hampshire ($200 per year). In about 30 States the *per diem* method prevails, the amount varying from $3 per day in Kansas and Oregon to $10 per day in California, Iowa and Kentucky, the most general amount being $4 or $5 per day. Mileage, ranging from 10 cents per mile to 25 cents, is usually allowed and frequently there is a small allowance for stationery and newspapers. In some States the amount of compensation is fixed by the constitution; in some the maximum amount is specified, in others the determination of the amount is left entirely to the legislature, usually subject, however, to the limitation that no increase may take effect during the term for which the legislature making it is elected. In the majority of States the legislature holds regular sessions every two years, but in Massachusetts, New York, New Jersey, Georgia and South Carolina annual sessions are held. Alabama alone of all the States is content with quadrennial sessions. In all the States the governor is empowered to call extraordinary sessions, but usually the legislature is restricted at such sessions to the considerations of only such matters as are specified in the governor's proclamation. In many States the length of the legislative session is limited by the constitution to a certain number of days — 40, 60 or 90, with a view to preventing long-drawn-out sessions. In other States the same end is accomplished by constitutional enactments providing that at the expiration of a certain number of days the pay of the legislature shall cease.

The powers of the State legislature, unlike those of Congress, are not specifically enumerated by the constitution. In this respect they are more like those of the English Parliament. A State legislature, therefore, may usually exercise any legislative powers which have not been delegated to Congress or prohibited to the legislature by the Federal or State Constitutions. Their powers are consequently very wide and as President Woodrow Wilson has well said in his book on 'The State,' the attempt to enumerate them would involve cataloguing all the business and social relationships of life — obviously an impossible task. Among their powers may be mentioned the enactment of the civil and criminal law, the law of judicial procedure, the law of business, of contracts, partnerships, agency and the like, the regulation of trade, industry and the professions, local government, public health, the public safety, education, charity, marriage and divorce, railways, elections and hundreds of other matters. As a result of the action of the courts in declaring important acts of the legislature unconstitutional for excess of power there has been a disposition in recent years to enumerate in the constitution certain matters upon which the legislature is authorized to enact laws, the purpose being to remove doubt as to the power of the legislature in respect to such matters.

In consequence of the popular distrust of the legislatures, there has been a tendency in recent years to impose constitutional limitations on their powers, particularly in respect to the incurring of debts, the levying of taxes and the appropriation of money. Many constitutions forbid the enactment of local or special laws where a general law would be applicable or they allow it only under certain restrictions. These restrictions have had the effect of reducing the output of legislation in many States and of removing well-known evils that are inseparable from private and local legislation. See also CONGRESS; LEGISLATION; REFERENDUM; PARLIAMENT; SENATE.

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LEGITIM, (1) in Scots law, the share of the movable property which descends to children on the death of the father, amounting to one-third when the widow survives and one-third to her as her jus relictæ (q.v.). The father can dispose of the remaining third, which was called "dead's part," as he desires by will. If no widow survived, one-half was legitim and one-half dead's part. (2) In civil law, that part of a man's personal property which descends to his children at his death. It amounted to one-fourth in Roman law. It is embodied in the law of Louisiana. The word is also spelled legitime.

LEGITIMACY. As a law term "legitimacy" is employed mainly to describe the status of children born in lawful wedlock. The meaning of the term will be best understood by contrasting the condition of illegitimate with that of legitimate children. A child born out of wedlock is *nullus filius;* it has no legal parents. Neither its mother nor its putative father have any parental obligations toward it, and, when the public authorities intervene to compel a parent to support his or her illegitimate offspring, the action is taken in the public interest, to prevent the child from becoming a public charge, and not because of any inherent legal right of the bastard. Primarily the authorities look to the mother to provide for the child, but where the maternal parent lacks ability to support it the putative father may be proceeded against. In some countries the law will not inquire into the paternity of a bastard, however. An illegitimate child is incapable of inheriting either from its mother or putative father or, from the collateral relations of either; in the eye of the law a bastard has neither ancestors nor next of kin. Another child born to its parents, whether in or out of wedlock, stands in no legal relation toward it with respect to property. Nor do its own parents inherit anything from an illegitimate child which dies intestate. Only the legitimate descendants of persons born out of wedlock inherit from them by law; if they have no descendants their property escheats to the State. In other respects the civic status of a person is not affected by illegitimacy. He can hold and acquire property by gift or by will and dispose of the same like any natural person; and, though titles and estates of inheritance do not descend to him by law, he can become the founder of a family and become the possessor of a name in his own right. The bar sinister, which heraldry required illegitimate sons to blazon on their escutcheons, was often borne by great men, conscious of their own worth, without a sense of disgrace; and to be «his own ancestor» was the pride of more than one of the heroes of history.

A child born in wedlock is presumably legitimate, though evidence that husband and wife had not lived together for a period so long as to preclude the possibility of the former having been the father would rebut the presumption. Under the common law the presumption of legitimacy was conclusive unless the father was shown to have been «beyond the four seas» for more than nine months prior to the birth of the child; if, during that time he was within the kingdom, the presumption of his fatherhood could not be combated even by proof that he was continuously absent from his domicile. This hard and fast rule has now been relaxed, and in England, as everywhere, fatherhood may be disproven by any competent evidence. Children of marriages which are found to have been nullities because of legal impediments are illegitimate, just as are children resulting from illicit intercourse. The harshness of this rule has been ameliorated to some degree by the doctrine of «putative marriage.» One party to an annulled marriage having been unaware of the disqualifying impediment, that party and the children of the marriage are entitled to all the rights that would have been theirs if the marriage had been valid. The children of the union are to be regarded as legitimate. This canon has become a rule of equity. In England legitimacy may be established by proceedings in court under the statute (21 and 22 Victoria chap. 93) passed in 1858. It was under this law that an ignorant butcher from the antipodes tried to prove his title to the Tichborne estate; and he found many believers in his claim, including the mother of the real heir.

Proposals were frequently made by the mediæval church to the lay authorities that children born out of wedlock be legitimized by the subsequent marriage of their parents. In 1235 the English bishops, in their capacity of lords spiritual, endeavored to make the proposal a law. In the record of the Statute of Merton (20 Henry III, chap. 9) the repudiation of the principle by the lords temporal is set forth as follows: The bishops having «instanted the lords that they would consent that all such as were born afore matrimony should be legitimate as well as they that be born within matrimony, as to succession of inheritance, forasmuch as the church accepteth such as legitimate . . . all the earls and barons answered with one voice that they would not change the laws of the realm which had hitherto been used and approved.» The law of England remains unchanged in this respect, and the rule was also followed in the United States as part of the common law. By statute in most of the States a child born out of wedlock is now legitimized by the marriage of its parents. This is, and has long been, the rule in practically all countries inhabited by people of European race. In political history legitimacy has reference to sovereign successions by «divine right.» Legitimists regard all breaks in the right line of descent as usurpations of sovereignty, particularly when the breaks have been caused by parliamentary depositions of kings and by popular revolution. According to the ‘Legitimist's Almanach,’ published up to recent times, the Comte de Chambord was Louis XIX, king of France, Don Carlos was king of Spain; Sicily, Naples, Modena, Parma and other parts of Italy were still under their former Bourbon kinglets, while Maria Theresa, Duchess of Este and late consort of former King Ludwig III of Bavaria, was known as the «White Rose Queen» and regarded by the Jacobites as the legitimate sovereign of Great Britain, Ireland and the dominions beyond the seas, she being a descendant of the elder and deposed branch of the Stuarts.

Stephen Pfeil.

LEGITIMATION, the act of conferring legitimacy (q.v.) on a person born out of wedlock. It is effected by act of the legislature, by adoption or by the subsequent marriage of the father and mother of the bastard. The latter means, however, can only be had provided the father and mother were free to marry at the time of the birth, and that there was no diriment impediment to such marriage. In England, Ireland and in a few of the United States legitimation by subsequent marriage does not obtain, the maxim there being, «once a bastard, always a bastard.» In most States, however, such a marriage legitimizes previous offspring. Complications arise where after the child's birth, one of the parents marries a third person, has children, and after the dissolution of this marriage, marry. The general rule in such cases is to confer a status of legitimacy on the bastard child, but not to displace the legitimately-born children by the latter. See Bastard; Illegitimacy; Legitimacy; and consult ‘Legitimation by Subsequent Marriage’ (in *Journal of Society of Comparative Legislation,* Vol. VI, new series, London 1906).

LÉGITIME, François Denys, fräṅ-swä dĕ-nē lā-zhē-tēm, Haitian general: b. 1842. During the administration of President Salomon, he was accused of aspiring to the Presidency, and accordingly went to Kingston, Jamaica, remaining three years, then returned to Haiti at the invitation of his followers, and on 7 Oct. 1888 was elected President of the provisional government. General Thélémaque denounced the election as a job, and attempted to make himself President, but he was killed in the battle which ensued. Légitime was elected

President of Haiti 17 Dec. 1888, but resigned in 1889, owing to the opposition of General Hippolyte, and again retired to Jamaica. In 1896 President Sam granted a general amnesty, and he returned to Haiti.

LEGITIMISTS, The, in French history the supporters of the claims of the elder Bourbon line, descended from Louis XIV, against those of his younger brother, Philippe, Duc d'Orleans. The party existed from the overthrow, in 1830, of Charles X, who was of the elder Bourbon line and was succeeded by Louis Philippe, an Orleanist. The Bourbons became extinct with the death of the Comte de Chambord in 1883, and the claims of both lines were united in the Comte de Paris, grandson of Louis Philippe. In Spanish history the term is used to designate an adherent of the pretender, Don Carlos de Bourbon (1788–1855), second son of Charles IV of Spain, and his descendants, in claims to the throne of Spain. The word *légitimiste* was not admitted by the French Academy until 1878, but it had already been accepted in both French and English usage, meaning a supporter of hereditary right to govern as against parliamentary rule.

LEGLER, Henry Eduard, American librarian: b. Palermo, Italy, 22 June 1861; d. 13 Sept. 1917. He was educated in Switzerland and in the United States. He was a member of the Wisconsin assembly in 1889, secretary of the Milwaukee school board in 1890–1904, secretary of the Wisconsin Library Committee in 1904–09, and from 1909 was librarian of the Chicago Public Library. In 1912–13 he was president of the American Library Association. Author of 'Chevalier Henry de Tonty' (1896); 'Leading Events of Wisconsin History' (1897); 'The Genesis of Poe's Raven' (1907); 'Of Much Love and Some Knowledge of Books' (1912), etc.

LEGNAGO, lā-nyä'gō, Italy, city in the province of Verona, on the river Adige, 33 miles by rail southeast of Verona. It is one of the series of towns fortified by the Austrians in 1815, known as the Quadrilateral, its original fortifications having been destroyed by Napoleon in 1801. The surrounding country is low and marshy but highly productive; sugar, rice and other cereals are grown and the town has a thriving trade in agricultural produce. Pop. town, 2,731; commune, 17,000.

LEGNANO, Italy, city in the province of Milan, on the river Olono, 16 miles northwest of Milan. It has a ruined castle of the Visconti and its church of San Magno, dating from 1529, has an altarpiece by Bernardino Luini which is considered among his finest work. Near here the Lombard League was victorious over the forces of Frederich of Barbarossa in 1176. There are important silk and cotton factories and other textile industries, as well as machine-shops and boiler works. Pop. commune, 24,364.

LEGOUIS, lĕ-goo'ē, **Emile,** French literary critic: b. Honfluer, Calvados, 1861. He studied at the universities of Caen and Paris, was appointed lecturer and professor at the University of Lyons in 1885 and in 1904 became professor of English language and literature at the Sorbonne. He was exchange professor at Harvard in 1912–13. Author of 'Thomas Gray; Choix de poésies' (1887); 'Le général Beaupuy' with Bussière, G. (1891); 'La Jeunesse de William Wordsworth' (1896; Eng. trans., 1897); 'Quelques poèmes de Wordsworth' (1896); 'Morceaux choisis de littérature anglaise' (1905); 'Défense de la poésie française à l'usage des lecteurs anglais' (1912); 'William Wordsworth' in 'Cambridge History of English Literature' (Vol. XII, 1914), etc.

LEGOUVÉ, lĕ-goo-vā, **Gabriel Ernest Wilfrid,** French dramatist and miscellaneous writer: b. Paris, 15 Feb. 1807; d. 14 March 1903. In 1827 he won a prize of the Academy with a poem on the art of printing, 'Découverte de l'imprimerie.' While instructor in the Collège de France 1847, he lectured on the history of woman's development; and later published 'Moral History of Women' (7th ed., 1882), and 'Woman in France in the 19th Century' (1864). These works were received with great favor, and were followed by 'Science of the Family' (1867), and 'Messieurs the Young Folk' (1868). Meanwhile Legouvé was winning high distinction as a playwright with 'Louise de Lignerolles'; 'Adrienne Lecouvreur' with Scribe (1849); 'Medea'; 'By Right of Conquest'; 'Miss Suzanne' (1867); 'Anne de Kerwiler' (1879); 'Considération,' etc. In 1882 he published 'Recollections of Sixty Years,' and in 1890 'Winter Flower, Winter Fruits: Story of my Household.' In 1885 he became a member of the French Academy.

LEGOUVÉ, Gabriel Marie Jean Baptiste, French poet and dramatist: b. Paris, 23 June 1764; d. Montmartre, 1812. He was father of Gabriel Jean Baptiste Ernest Wilfrid Legouvé (q.v.). His verse was extremely popular and of his plays 'La mort de Henri IV' (1806) was most successful. He was elected to the Academy in 1798. The death of his wife in 1810 caused the loss of his reason and he died in a sanatorium. Author of the dramas 'La mort d'Abel' (1792); 'Epicharis' (1793); 'Quintus Fabius' (1795); 'Etéocle' (1799); 'La mort de Henri IV' (1806). Of his poems 'Le Mérite des femmes' (1801) reached 40 editions.

LEGRAIN, lĕ-grăṅ, **Georges Albert,** French archæologist: b. Paris, 4 Oct. 1865. He was educated at the College de France. He was appointed a member of the Institut Français d'Archaéologie Orientale at Cairo in 1892, and in 1894 was made inspecteur-dessinateur of the museum there. In 1895 he was given direction of the reconstruction of the great temple of Ammon at Karnak, where in 1904 the excavations made in the progress of the work disclosed an enormous collection of buried statuary, comprising 800 stone statues and 17,000 of bronze. No find of similar magnitude had been made since Mariette's at Serapeum and it was rated as of vast historical importance. He was also engaged in the reconstruction of the temples of Rameses III, Osiris and Ptah. Author of 'Catalogue du Musée de Cairo'; 'Le statuette funéraire de Pathmos' (1904); 'Comment doit-on établir une généalogie egyptienne' (1906); 'La grande stéle de Toutank-hamanou à Karnak' (1907); 'Lougsor sans les Pharaons' (1914), etc.

LEGRAND, lĕ-grän', **Louis Désiré,** French lawyer and diplomatist: b. Valenciennes, 30

March 1842. He was educated at Paris, served in the Franco-Prussian War, was elected a member of the House of Deputies in 1876 and in 1882–95 he was Minister Plenipotentiary at The Hague. He is a chevalier of the Legion of Honor and was named corresponding member of the Academy of Sciences in 1890. Author of 'Du Divorce et de la séparation de corps' (1865); 'Sénac de Meilhan' (1868); 'Le Mariage et les mœurs en France' (1879); 'Compte rendu de la législature au nom de la gauche republicaine' (1881); 'L'Organisation des Indes néerlandaises' (1887); 'L'Idée de patrie' (1897); 'Précis de procedure civile usuelle et pratique' (1897; new ed., 1904), etc.

LEGRAND DU SAULLE, le-grän'dü sol, **Henri,** French physician and alienist: b. Dijon, 16 April 1830; d. Paris, 6 May 1886. He studied medicine at Dijon, served as interne at various hospitals and in 1862 took his M.D. at Paris. He was one of the editors of the *Gazette des Hospitaux* in 1854–62, engaged in the practice of medicine and in 1868 became connected with the prefecture of police, Paris, where he shared the labors of Lasègne. He was appointed physician at the Salpêtrière in 1879. He was one of the founders in 1868 of the Societe de Medicine Legale and was for many years connected with *Annales médico-psychologiques.* Author of 'La folié devant les tribunaux' (1864); 'La folie héréditaire' (1873); 'Traité de médecine legale' (1874); 'Etude médico-legale sur les épileptiques' (1877); 'Etude médico-legale sur l'interdiction des aliénés' (1880), etc.

LEGRENZI, Giovanni, Italian composer: b. Clusone, near Bergamo, 1625; d. Venice, 26 July 1690. He studied under Pallavicino and was appointed organist at the church of Saint Maria Maggiore at Bergamo. He later became *maestro di capella* of the church of the Spirito Santo at Ferrara and about 1664 he was appointed director of the Conservatorio dei Benedicanti at Venice. In 1681 he became *vice-maestro* and in 1685 *maestro di capella* at Saint Mark's, Venice, where he remained until his death. His most famous pupils were Lotti and Gasparini. His compositions have a wide range but he is most famous for his operas, of which he wrote 17 and which surpassed anything then written in the instrumentation as well as possessing other merits. Among them are 'Achille in Sciro' (1664); 'La Divisione del Mondo' (1675); 'I due Cesari' (1683); 'Pertinace' (1684), etc.

LEGROS, lĕ-grō', **Alphonse,** Anglo-French artist: b. Dijon, France, 8 May 1837; d. London, 8 Dec. 1911. In 1857 he exhibited for the first time in the Salon, but finding small encouragement in France, removed to London in 1863, became a naturalized Englishman and was appointed in 1870 Slade professor in University College. His work, alike in painting, etching and modeling, is strongly mannered, and as a colorist his range is limited. He presents the rural scenes and peasantry of France with an austere dignity of style and force of expression, which though they did not make him popular won generous recognition from his brother artists. His more important works are the 'Anglers,' the 'Pilgrimage,' the 'Spanish Cloister,' the 'Benediction of the Sea,' the 'Baptism,' the 'Coppersmith,' the 'Dead Christ,' 'Woman Praying,' 'Public Penance,' and 'On the Edge of the Woods,' which last is in the Metropolitan Museum, New York. His versatility was extraordinary — pen and pencil drawings, medal work, portraiture, etchings and sculpture having each the marks of his pronounced individuality. But his fame is perhaps greatest in his etched portrait work and this gave him a distinctive place in contemporary art. Among his subjects were Watts, Poynter, Leighton, Carlyle and Manning. Noteworthy etchings are 'Death and the Woodman,' and 'Le Repas des Pauvres,' both marked by a fine breadth in conception and handling. His monumental fountain at Welbeck Abbey is perhaps his best piece of sculpture.

LEGUIA, lā-goo'yä, **Augusto B.,** Peruvian financier and statesman: b. Lambayeque, 19 Feb. 1864. He studied at Valparaiso, Chile, served in the Chilean-Peruvian War and afterward became prominent in financial circles. He became Minister of Finance in 1904 and was elected President in 1908. A revolutionary uprising by the followers of Pierola endeavored to gain control of the government in 1909, and on 29 May succeeded in taking President Leguia prisoner. Loyal government forces came to his rescue within an hour, however, and order was promptly restored. His administration saw the boundary dispute with Bolivia settled in favor of Peru and also the resumption of friendly relations with Chile, with whom there had been ill-feeling over boundary decisions. Upon the expiration of his term as President he took up his residence in London.

LEGUME, lĕg'ūm, the fruit or seed of plants of the *Leguminosæ* or pulse family. The seed vessel, or pod, has one cell and two valves; is generally dehiscent, opening down both sides, the seeds being borne on the ventral suture. Peas and beans form the most familiar members of the group. Indehiscent legumes, which at maturity break into one-seeded parts, are known as loments.

LEGUMIN, or vegetable casein, a protein substance analogous to the casein of milk, obtained from beans, pease, lentils, vetches and other leguminous seeds; the principle of the *Leguminosæ.*

LEGUMINOSÆ, a group of plants formerly considered a family, but now generally divided into three families. The term, however, is a convenient one and is retained for the group as a whole. The plants are herbs, shrubs and trees widely distributed in all climates but most numerous in tropical and subtropical regions; growing upon all kinds of soil; exhibiting a great range of habit from creeping annual to climbing shrub; useful for a great variety of purposes — ornament, food, timber, fodder and in the arts; and constituting one of the largest groups of plants, about 7,000 species distributed among about 450 genera. The species are characterized by alternate, stipulate, usually compound leaves; papilionaceous or sometimes regular flowers commonly arranged in racemes; monadelphous, diadelphous or occasionally distinct stamens, typically 10, surrounding a single simple pistil which generally becomes a pod or legume containing one to many seeds.

The species naturally fall into three families: (1) *Fabaceæ*, with flowers resembling a butterfly; (2) *Cæsalpiniaceæ*, with imperfectly or not at all papilionaceous corollas, which may sometimes be nearly regular; (3) *Mimosaceæ*, with small, regular flowers. The first group contains more than two-thirds of the species. Its members are adapted for insect fertilization, especially by bees, which alight upon the lower petals, brush against the pistil which is thrust out by the insect's weight, then come in contact with the stamens and finally carry the pollen, which has been discharged, to other flowers. Thus the pistils receive pollen from stamens not in the same flower with them. In some instances they may also obtain pollen from these stamens, thus having a double chance to be fertilized. See Flowers and Insects.

Perhaps the most interesting trait found in the group is the power possessed by the species of obtaining free nitrogen from the air by means of the tubercles or wart-like excrescences upon their roots. These tubercles are the homes of bacteria which have gained entrance to the plant's tissue through the root-hairs and are thus the result of irritation. The plants, it is believed, furnish the bacteria with carbohydrate food in return for the nitrogenous material prepared by them, thus exhibiting excellent examples of symbiosis (q.v.). Largely owing to this reciprocal action, the legumes are valued as green manures, a fact long acted upon but unexplained until the last quarter of the 19th century, when Hellriegel and other investigators proved it, and even went further to show that soils poor in the bacteria could be inoculated profitably. See Clover; Nitrogen; Root-Tubercles; Green Manuring; Vetch; Cowpea; Bean; Lupine; Acacia; Licorice; Indigo; Sweet Pea; Medic; Laburnum; Tamarind; Mimosa.

LEHAR, lā'hār, **Franz**, Austrian composer: b. Komron, Hungary, 30 April 1870. He was educated at the Academy of Music at Prague and was successively concert master at the Elberfeld Opera, a regimental bandmaster in the Austrian army 1890–1902 and conductor at the Vienna Theatre. His light opera, 'Die lustige Witwe' ('The Merry Widow'), produced at Vienna, 30 Dec. 1905, brought him worldwide fame and a great fortune. He is also author of 'Wiener Frauen' (1902); 'Die Juxheirat' (1904); 'Mitislav der Moderne' (1906); 'Der Graf von Luxemburg' (1909); 'Le roi des Montagues' (1914), etc.

LEHI, lē'hī, Utah, city in Utah County, 31 miles south of Salt Lake City, on the north shore of Utah Lake, and on the Denver and Rio Grande and San Pedro, Los Angeles and Salt Lake railroads. It is situated in an irrigated farming district chiefly interested in raising sugar beets and fruit. There is a canning factory and a sugar refinery. Pop. 2,964.

LEHIGH, lē'hī, a river of Pennsylvania which has its rise east of Wilkesbarre, in Luzerne County, and flows nearly south to a point about 12 miles below Mauch Chunk, where it breaks through the Blue Ridge. From here its course is southeast to Allentown, then northeast to Easton, where it enters the Delaware River, after a course of about 120 miles. In its upper course it is a rapid and picturesque mountain stream, broken by several falls. It passes through a rich coal and iron-ore region, and serves as an outlet for the products of the mines. It was made navigable by a series of extensive improvements to Whitehaven, 84 miles from its mouth. The Lehigh Valley Railroad follows the course of the river for nearly its entire length.

LEHIGH UNIVERSITY, an institution at South Bethlehem, Pa., founded by Asa Packer (q.v.) in 1866. His endowment of the university, including an appropriation of land, totaled about $3,000,000, said to be the largest donation by one American to the cause of education up to that time. The original object of Judge Packer was to "afford the young men of the Lehigh Valley a complete education, technical, literary and scientific, for those professions represented in the development of the peculiar resources of the surrounding region." Lehigh's growth has carried it far beyond local scope. The student body of the first year numbered 40 young men from four States and one foreign country. In 1916 there were 775 students, representing 30 States and 12 foreign countries. The teaching staff has increased from 7 in 1866 to 78 at this time. The alumni body, including graduates and non-graduates, representing Lehigh in all parts of the world, numbers about 6,000. There is now a campus and park of more than 160 acres, with 20 buildings, a stadium and an additional playing field. For beauty of natural surroundings and architecture, Lehigh's lay-out is regarded as one of the finest in the entire country. The 20 buildings include Packer Hall, Packer Memorial Church, Fritz Engineering Laboratory, the Linderman Library, with 130,000 volumes, Drown Memorial Hall, College Commons and Taylor gymnasium and field house. There are eight technical courses: civil engineering, mechanical engineering, metallurgical engineering, electrometallurgy, mining engineering, electrical engineering, chemical engineering and chemistry. In the arts and science department there are courses leading to the degree of bachelor of arts and of bachelor of science. A course in business administration is included. The master's degrees in arts and sciences are granted in graduate courses. The proximity of the plant of the Bethlehem Steel Company and of cement, zinc, coal mining and other important industries affords opportunities for study by classes accompanied by instructors. In 1915 the productive funds of the university were $1,480,000 and the income $256,754.

LEHIGH VALLEY RAILROAD COMPANY, The, was incorporated by an act of the legislature of Pennsylvania, 21 April 1846, as the Delaware, Lehigh, Schuylkill and Susquehanna Railroad Company; its name was changed to Lehigh Valley Railroad Company 7 Jan. 1853.

The Lehigh Valley Railroad system is today a double-track trunk line extending through the States of New Jersey, Pennsylvania and New York, from the Atlantic Seaboard to the Great Lakes. The main line runs from New York to Buffalo, N. Y., a distance of 448 miles. The entire mileage of the system in 1916 was 1,443.69 miles, of which 596.47 miles was double track. The company possesses terminals on the Hudson River front opposite

New York city, at Perth Amboy, N. J., and on Lake Erie at Buffalo, N. Y. The company also controls the Lehigh Valley Coal Company and the Morris Canal, 106.48 miles in length. At the eastern end of the line in New York harbor the company owns a fleet of 286 boats.

The rolling equipment of the road 30 June 1916 consisted of 971 locomotives (passenger, freight and switching), 631 passenger-car equipment, 43,579 freight-car equipment (of which 18,322 are coal cars). The total earnings of the system for the year ended 30 June 1916 were $47,382,569; expenses of operation for the same period, $33,092,978; net earnings from operations, $14,289,591; percentage, operating expenses to gross earnings, 69.82 per cent. The amount of merchandise freight moved for the year ending 30 June 1916, exclusive of company's material, was 19,752,591 tons. For the same period the coal tonnage, not including supply coal, amounted to 13,959,754 tons; the coal tonnage amounted to 70.67 per cent of the total tonnage hauled during the year.

LEHIGHTON, Pa., borough in Carbon County, on the Lehigh River, and on the Central of New Jersey and the Lehigh Valley railroads, about 75 miles northeast of Harrisburg, the capital of the State, and 70 miles, in direct line, northwest of Philadelphia. It is a trade centre for a mining section of the county. Its chief manufactures are silk and lace, meat-packing, shirts, stoneworks, car-springs, flour, leather, stoves, furniture, brick and mining tools. The borough owns the electric-light plant, but leases it to a private corporation who operates it. The fair grounds of the County Industrial Society are located here. Pop. 5,316.

LEHMANN, lā'man, **Alfred Georg Ludvig**, Danish psychologist and psychophysicist: b. Copenhagen, 1858. He was graduated at the University of Copenhagen, and later studied at the University of Leipzig under W. Wundt, who greatly influenced his later career. He was in 1890 appointed docent, and in 1910 professor, at the University of Copenhagen, where he founded a psychophysical laboratory. The Society of Sciences awarded him a gold medal for his 'Hovedlovene for det menneskelige Fölelsesliv' (1892). He is also author of 'Overtro og Troldom' (4 vols., 1893–96; translated into German); 'De sjælelige Tilstandes legemlige Ytringer' (3 vols., 1898; German trans. 1899–1905); 'Psychologische Methodik' (1905); 'Grundzüge der Psychophysiologie' (1912); 'Paedagogisk Psykologi' (1913).

LEHMANN (Charles Ernest Rodolphe), Henri, French painter: b. Kiel, Schleswig, 14 April 1812; d. 31 March 1882. He studied under his father, Leo Lenmann, and under Ingres in Paris, visited Munich and Italy, and in 1847 settled at Paris where he became naturalized. He as first painted scriptural subjects but eventually confined himself chiefly to portrait work, in which field he made a considerable reputation. He also executed mural decorations, among them the chapel of the church of Saint Merry, and the Throne Hall, Luxemburg Palace. He became a chevalier of the Legion of Honor in 1853, a member of the superior council of the Beaux Arts in 1875, and professor at the École des Beaux Arts. His works include 'Tobias and the Angel' (1835); 'Jeptha's Daughter' (1836); 'Jeremiah' (1842), Angers Museum; 'Leonidas' (1848), Nantes Museum; 'Adoration of the Magi and Shepherds' (1855), Rheims Museum; 'Rest' (1864), Luxemburg Museum; 'Calypso' (1870); portrait of himself, Uffizi Gallery, Florence; and portraits of Liszt, Ingres, Edmond About, etc.

LEHMANN, Frederick William, American lawyer: b. Prussia, 28 Feb. 1853. He was graduated at Tabor College, Iowa, in 1873 and was admitted to the bar in that year. He engaged in practice at Nebraska City in 1873–76, Des Moines, Iowa, in 1876–90, and since then has practised at Saint Louis. He was solicitor-general of the United States in 1910–12. He was a government delegate and chairman of the committee on plan and scope at the Universal Congress of Lawyers and Jurists in 1904; and United States delegate to the A. B. C. mediation confer nce at Niagara Falls in 1914. He was president of the American Bar Association in 1908–09, and second vice-president of the American Academy of Jurisprudence in 1914.

LEHMANN, Johannes Edvard L., Danish theologian and historian: b. Copenhagen, 19 Aug. 1862. He studied in Lund, Germany, Holland, England and Paris, and took his Ph.D. at the University of Copenhagen in 1896. He became docent in the history of religion at Copenhagen in 1900, professor of that subject at Leyden in 1909 and at the University of Berlin in 1910. Author of 'Zarathustra' (2 vols., 1899–1902); 'Mystik i Hedenskab og Kristendom' (1904; German trans. 1907); 'Buddha' (1907); 'Textbuch zur Religionsgeschichte' (1912); 'Barnelærdom og Ynglingsliv' (1913), etc. He also edited and revised De la Saussaye's 'Lehrbuch der Religionsgeschichte' (4th ed., 1912).

LEHMANN, Karl Bernhard, German physician: b. Zürich, 27 Sept. 1858. He studied at the University of Zurich and in 1881 was appointed assistant in the physiological institute there. He was physiological assistant at Munich from 1883 until he became assistant professor of hygiene at Würzburg in 1887, where he was appointed professor in 1894. Author of 'Methode praktischer Hygiene' (2d ed., 1901; Eng. trans., Crookes, 1893); with Neumann, R. O., 'Atlas und Grundriss der Bakteriologie' (1897; 5th ed., 1911); 'Der Bedeutung der chromate für die Geshundheit der Arbeiter' (1914), etc.

LEHMANN, Lilli, German operatic singer: b. Würzburg, 1848. Her mother, who was harp-player and prima donna under Spohr at Cassel, gave her the first musical instruction and under her training Fräulein Lehmann developed a remarkable soprano voice. She made her début in Berlin (1870) and subsequently produced so good an impression that she was appointed imperial chamber singer in 1876. She became famous from the parts she took in the Nibelungen trilogy at Baireuth, and sang in Wagner's operas in London (1884), and as principal soprano in the same operas at the Metropolitan Opera House, New York, her principal rôles being Brünhilde and Isolde. From 1885–90 she was mainly at the Metropolitan Opera House, New York, and in 1899 appeared at Covent Garden, London, in a round of parts. On her return to Germany she found herself debarred from appearing on the operatic stage through having outstayed the leave given her by the Berlin Opera, but through the personal intervention of the emperor, the prohibition was removed. In 1888 she was married to Paul Kalisch.

LEHMANN, Liza, English singer and composer: b. London, about 1862; daughter of Rudolf Lehmann (q.v.). She studied vocal music at London and Rome, and composition under Freudenberg and Hamish MacCunn. On 23 Nov. 1885 she made her début in London; her success was assured, and she was received well throughout Great Britain and Germany. In 1894 she retired from public singing on her marriage with Mr. Herbert Bedford, a well-known composer. She devoted herself henceforth to composition and produced works of freshness and originality, many of them tinged with a refined feeling which recalls the modern German romantic or emotional school. Her most successful works are the 'Persian Garden'; and 'The Daisy Chain' (1901).

LEHMANN, Peter Martin Orla, Danish statesman: b. Copenhagen, 19 May 1810; d. there, 13 Sept. 1870. He was educated in law at the University of Copenhagen and while of German descent early affiliated himself with the Danish national party. He was a contributor to *Kjöbenhavnsposten* in his student days and in 1839–42 was one of the editors of the *Fädrelandet,* which he founded with C. N. David. He was active in the affairs of 1848, was foremost in the party which insisted upon the Eider as the Danish boundary and maintained that Schleswig was an integral part of Denmark. He was a member of the cabinet formed by Count A. W. Moltke in 1848 and was sent to London and Berlin on missions concerning Schleswig-Holstein affairs. He was a member of the Folketing in 1851–53; of the Landting in 1854–70; and of the Reichrat in 1856–66. He was Minister of the Interior under Hall in 1861–63. He had a wide following, was liberal in his policies and a firm believer in the maintenance of Danish rights against German aggression. Author of 'Om Aarsagerne til Danmarks Ulykke' (1864), which ran through eight editions and was translated into English. His collected works were published (4 vols., 1872–74).

LEHMANN, Rudolf, Anglo-German painter and writer: b. near Hamburg, 19 Aug. 1819; d. Bushey, Herts, 27 Oct. 1905. He was educated at the Johanneum, Hamburg, and proceeding to Paris studied painting under his brother, Henry Lehmann; he was afterward the pupil of Cornelius and Kaulbach (q.v.) at Munich. He went to Rome in 1839 and remained there 16 years. His largest picture is 'The Blessing of the Pontine Marshes by Sixtus V,' which was bought by the French government after being exhibited in France 1846. He also executed for the French government a 'Madonna and Child.' In 1866 he settled in London and became a successful portrait painter, his work being distinguished by a reposeful dignity. He published 'An Artist's Reminiscences' (1894); 'Men and Women of the Century' (1896).

LEHMANN, Rudolph Chambers, English journalist, lawyer and politician: b. near Sheffield, England, 3 Jan. 1856. He was educated at Cambridge and became a barrister of the Inner Temple in 1880. He has been a member of the staff of *Punch* from 1890 and was editor of the London *Daily News* in 1901. He coached the Harvard crew in 1896 and 1897. He is a keen politician and represented the Harborough division of Leicestershire in the Liberal interest from 1906–11. He has published among other works 'In Cambridge Courts' (1891); 'Mr. Punch's Prize Novels' (1893); 'Isthmian Library: Rowing' (1897); 'Anni Fugaces,' verse (1901); 'Adventures of Picklock Holes' (1901); 'Crumbs of Pity' (1903); 'The Complete Oarsman' (1908); 'Memories of Half a Century' (1908); 'Light and Shade' (1909); 'Charles Dickens as Editor' (1912); 'A Spark Divine' (1913).

LEHMKUHL, lĕm'kool, **Augustinus,** German Catholic theologian: b. Hagen, Westphalia, 23 Sept. 1834. He was educated at Essen-Ruhr and at various scholasticates of the Jesuit order, which he entered in 1853. He was ordained to the priesthood in 1862 and became successively professor of Sacred Scripture, dogmatic theology and moral theology at the scholasticates of Maria-Laach (1862–72) and Ditton Hall, England (1873–80). Since 1880 he has resided mostly in Holland and devoted himself to literary pursuits. He published 'Herz Jesu Monat' (1861; 11th ed., 1912); 'Theologia moralis' (2 vols., 1883; 11th ed., 1910); 'Compendium theologiæ moralis' (1886; 5th ed., 1907); 'Arbeitsvertrag und Strike' (4th ed., 1904); 'Die soziale Not und der kirchliche Einfluss' (4th ed., 1905); 'Die soziale Frage und die staatliche Gewalt' (3d ed., 1896); 'Internationale Regelang der sozialen Frage' (3d ed., 1896); 'Der christliche Arbeiter' (3d ed., 1902); 'Das bürgerliche Gesetzbuch des deutschen Reichs' (7th ed., 1911); 'Das Herz des göttlichen Menschenfreundes' (2d ed., 1906); 'Casus Conscientiæ' (2 vols., 4th ed., 1900); 'Probabilismus vindicatus' (1906); 'Das Gattesbrot' (2d ed., 1912). He collaborated in Herder's 'Kirchenlexikon' and 'Konversationslexikon,' etc., and edited many compendia and manuals. Dr. Lehmkuhl is known far beyond his own country due to the fact that his theological works and the 'Casus Conscientiæ' are the textbooks in nearly all the Catholic seminaries of the world.

LEHR, lär, **Julius,** German economist: b. Schotten, Hesse, 18 Oct. 1845; d. Munich, 10 Oct. 1894. He was educated at Giessen, became privatdocent in economics at Munich in 1868, professor at Karlsruhe in 1874, and from 1885 until his death was professor at Munich. Author of 'Schutzzoll und Freihandel' (1877); 'Politische Oekonomie in gedrängter Fassung' (4th ed., 1905); 'Produktion und Konsumtion in der Volkswirtschaft' (1895; ed. by Frankenstein), etc.

LEHR, Paul Ernest, French jurist, author and educator: b. Saint-Dié, Vosges, 13 May 1835. He was educated at Strassburg and was admitted to the bar there. He was engaged in the defense of Strassburg as a captain in the National Guard in 1870, and after the fall of the city he retired to Lausanne, Switzerland. In 1875 he was appointed professor of comparative jurisprudence at the Academy of Lausanne, and in 1877 he was appointed to a post in the French embassy in Switzerland. His contributions to the knowledge of foreign law were important. Author of 'Eléments de droit civil germanique' (1875); 'Eléments de droit civil russe' (2 vols., 1877-90); 'Eléments de droit civil espagnol' (2 vols., 1880-90); 'Eléments de droit civil anglais' (1885); 'Le nouveau code pénal portugais' (1888), etc.

LEHRS, lārs, **Karl,** German classical scholar: b. Königsberg, 2 June 1802; d. there, 9 June 1878. He was of Jewish descent, but became a Christian in 1822. He was educated at the University of Königsberg, and from 1845 until his death he was professor of ancient Greek philology there. He was the originator of a new system for the study of Homer, explaining from the text itself, the method being embodied in his important work 'De Aristarchi Studiis Homericis' (1833; 2d ed., 1882). He was also author of 'Quæstiones Epicæ' (1837); 'De Asclepiade myrleano' (1845); 'Horatius Flaccus' (1869); 'Die Pindarscholien' (1873), etc.

LEIB, līb, **Michael,** American politician: b. Philadelphia, 1759; d. 1822. He was sent to the State legislature, and to Congress in 1798, where his pronounced political opinions made him conspicuous. Re-elected in 1800 and again in 1802, he opposed the administration of Jefferson, whom he had at first supported, and was politically associated with William Duane (q.v.), who published the *Aurora.* Returned to Congress in 1804, he there vigorously opposed Gallatin, and entering the Senate in 1808 was there especially hostile to both Madison and Gallatin. He left the Senate in 1814 to become postmaster of Philadelphia.

LEIBL, lī'b'l, **Wilhelm,** German genre and portrait painter: b. Cologne, 23 Oct. 1844; d. Würzburg, 4 Dec. 1900. He was a pupil of Piloty and of Ramberg at Munich, and in 1869-70 he was in Paris studying the methods of the French realists by whom his later work was largely influenced, although he was likewise an earnest student of Holbein's manner. He worked into his final representative manner — strength of line accompanied by delicacy of finish and fine coloring — through his early period of devotion to realism, and the second of painstaking particularity in detail. His work ranks among the best of his period in Germany, and he had a large following. He received the gold medal at the Paris Salon of 1870, the Prussian large gold medal and similar honors. He was a member of the Berlin Academy. His portraits ranked high and include one of his father (Wallraf-Ricartz Museum, Cologne); the painter, Paulsen (Berlin Gallery); Frau Gedon (gold medal, Paris Salon); the painter, Sperl (Budapest Gallery). His genre pictures dealt mainly with sturdy peasant types. Among them are 'Cocotte'; 'The Bachauer Peasant Women' (National Gallery, Berlin); 'Three Women in Church' (Hamburg Gallery); 'Two Poachers' (Berlin Gallery); 'A Provincial' (Pinakothek, Munich); 'In the Kitchen' (Stuttgart Museum), etc. He collaborated with Sperl, the landscape painter, in several canvasses, and also executed a number of fine etchings.

LEIBNITZ, līb'nĭtz, **Gottfried Wilhelm von, the most universal scientific genius of** modern times: b. Leipzig, 21 June 1646; d. Hanover, 14 Nov. 1716. He early lost his father, a professor of moral philosophy in the local university, and depended for his childish education mainly upon undirected omnivorous private reading. Having passed through the University of Leipzig, he graduated doctor of laws from Altdorf, near Nuremberg, in 1666, and passed almost at once into the service of the archbishop elector of Mainz, arch-chancellor of the empire, in whose interests he began the series of attempts to find a basis for the reunion of Western Christendom which occupied him at intervals through a great part of his life. In 1672 Leibnitz was dispatched to Paris in the hope that he might be able to promote the interests of the German states by diverting the ambitions of Louis XIV toward the conquest of Egypt. The mission failed of its intended effect, but the residence of Leibnitz in Paris, between 1672 and 1676, which was only broken by a brief visit to London in 1673, was of the utmost importance for the development of his thought, as it brought him into contact with the chief living exponents of Cartesianism, Arnauld and Malebranche, as well as with Huygens and other leading mathematicians. From this period date Leibnitz's critical study of Cartesianism and his introduction to higher mathematics, of which the first result was his discovery of the fundamental notions of the infinitesimal calculus. This discovery, made in 1675, was announced in 1676 to Newton, who promptly replied that he had for years been in possession of methods (the "method of fluxions") leading to the same results as those of his correspondent. The nature of these methods was however disguised in a couple of anagrams. Leibnitz did not actually publish his discovery until 1684; Newton's method was only given to the world in 1693. Leibnitz's later years were unfortunately much disturbed by a bitter controversy, which reflects little credit on either party, with the friends of Newton, who accused him of having stolen the idea of the calculus from papers of Newton's seen during his visit to England. It is now generally admitted that this charge, which was never made by Newton himself, was quite baseless, and that though Newton had elaborated his methods for private use as early as 1665, the discovery of Leibnitz was entirely independent, while his notation was so much more convenient that it has completely replaced that of his great rival, even in England.

On the termination of his residence in Paris Leibnitz spent several weeks in Holland in close communication with Spinoza, then living at The Hague, where he died in the following spring (1677). It appears that the two thinkers had repeated philosophical discussions, and that Leibnitz was even allowed to see the jealously guarded manuscript of Spinoza's 'Ethics.' His subsequent misrepresentation of the extent of this intercourse with the greatest thinker of the previous generation, which has only been exposed within recent years, is perhaps the greatest blot on Leibnitz's character. Leibnitz had already been deprived of his diplomatic position by the death of the Elector of Mainz in 1673. He now (1676) accepted from Johann Friedrich, Duke of Brunswick, the post of court-librarian at Hanover, which he filled for the rest of his life. Much of his time was henceforward taken up with public affairs and with preparation for a history of the House of Brunswick, in connection with which he spent two years (1687–89) in research in the archives of Austria and Italy. He negotiated long, but to no result, with Bossuet and Spinoza for the reunion of the Roman and Reformed churches, did much to promote the mining industry of the Harz district, and in especial labored to advance the organization of scientific research by the foundation of academies. The sole direct result of these last exertions was the creation in 1702 of the Berlin Academy with Liebnitz as its first president. Plans for similar institutions in Dresden, Vienna and Saint Petersburg proved abortive.

During the lives of Johann Friedrich and his successor, Ernst August, Leibnitz remained in high favor and enjoyed in particular the friendship of the "two Electresses," Sophia, wife of Ernst August and daughter of Descartes' correspondent, Elizabeth of the Palatinate, and her daughter, Sophia Charlotte, queen of Prussia. With the accession of the former's son, George Louis, afterward George I of England, to the dukedom he seems to have fallen into some disfavor, which, combined with the attacks of Newton's partisans, did much to embitter his last years.

Works.— In addition to his diplomatic and historical compositions, Leibnitz conducted an enormous scientific and philosophical correspondence, but his busy life left little time for the production of philosophical works on a large scale. He preferred to make his ideas known piecemeal in correspondence and occasional short essays on particular points. The one extended philosophical treatise published in his lifetime, the famous 'Theodicy,' a defense of natural theology against the sceptical attack of Bayle, is by general consent his poorest performance. (The far more important 'New Essays on Human Understanding,' a penetrating criticism of the empiricism of Locke, remained in manuscript until 1765; the even more valuable 'Discourse on Metaphysics,' composed in 1685 for Arnauld, was not printed until 1846. Even the famous 'Monadology,' the best known of his shorter philosophical essays, was only published in the original French by Erdmann in 1840). There is thus no such thing as an even approximately complete edition of the philosophical writings of Leibnitz. The best substitute available is afforded by the two editions of Gerhardt of the mathematical (Halle and Berlin 1850–63) and the philosophical works (Berlin 1875–90). But the recent publication by M. Couturat of a selection from the manuscript preserved at Hanover (Opuscules et fragments inédits de Leibnitz, Paris 1903), has shown that many things of first rate importance have been passed over in Gerhardt's editions, and has thrown a wholly new light on the logical foundations of Leibnitz's system. Though the great majority of the Hanover manuscripts are still unprinted, it is already clear that Leibnitz had anticipated to a previously unsuspected extent many of the most important recent developments in both mathematics and philosophy. Thus he had conceived the idea of projective geometry, and of the calculus of extension, while he had completely worked out the main principles of the exact logic recreated nearly 200 years later by Boole. Similarly the feasibility of the apparently chimerical project of a universal "characteristic," or philosophical symbolism independent of spoken language, to which so much of Leibnitz's thought was devoted, has only been shown in the last few years by its approximate realization in the mathematical logics of Peano, Freje and others.

Philosophical System.— Leibnitz makes his first appearance as a philosopher with a settled system of his own in 1685 at the age of 39, in the 'Discourse on Metaphysics' composed for Arnauld. He had previously passed successively under several different influences. In youth he had been familiar with the traditional doctrines of the great schoolmen, particularly with the nominalist system of Duns Scotus, and had afterward been powerfully influenced by the new materialist and mechanical philosophy of nature as expounded by Hobbes and Gassendi. During his stay in Paris he had been a profound student and acute critic of Cartesianism, and had subsequently, as we have seen, come into relations with Spinoza, who, however, failed from the first to satisfy him. At some time between 1675 and 1685 he had evidently further made a special study of Plato and Aristotle. The system of ideas at which he finally arrived bears traces of all these preparatory studies. In its general character it is correctly described by the common statement that it represents a reaction against the exclusively mechanical interpretation of nature and mind and a return to the spiritualistic and teleological conceptions of the Platonic-Aristotelian philosophy. Against the purely mechanical conception of extra-human nature assumed by Cartesianism Leibnitz maintains that the explanation of mechanical routine itself has always in the last resort to be found in final casuality, in purposive activity; against the Spinozistic conception of the illusoriness of all finite individuality, which he sincerely regarded as fatal to religion, he insists upon the ultimate and absolute reality of individual finite existence. At the same time, Leibnitz's system is one of pure and consistent rationalism; he aims at ruining the mechanical philosophy by showing that it collapses of itself when the attempt is made to think it out with rigorous consistency. Physical science is absolutely justified in demanding a mechanical explanation of all events without exception, but the very nature of mechanical explanation is such that it cannot be finally satisfactory, but demands a further metaphysical explanation in terms of individual purposive activity to make it intelligible.

In his most generally known works Leibnitz contents himself with expounding the consequences of this train of thought without clearly indicating the ultimate logical premises upon which it is based. What these premises are may best be learned from some of the papers recently printed by M. Couturat. In particular the little tract headed 'Primæ Veritates' (ultimate truths) contains a deduction of all the leading doctrines of the Leibnitian system, with one exception, from one or two ultimate logical theories. This sketch will be closely followed in the next few paragraphs.

The fundamental assumption from which Leibnitz starts is the doctrine (1) that all true propositions are analytical, i.e., the predicate of every true proposition is part of the meaning of its subject term. This is, in fact, the very meaning of the word truth. All ultimate truths are therefore identical and can be reduced to one of the two forms, *A is A* (Law of Identity), ***A is not non-A*** (Law of Contradiction, which Leibnitz wrongly regards as a mere verbal transformation of the Law of Identity). What we call an a priori or deductive proof is merely the reduction of a derivative proposition to a form in which this identity between subject and predicate is made explicit by means of logical analysis. So-called synthetic propositions, in which the predicate appears to involve a new determination of the subject, are merely propositions for which we have not succeeded in performing this analysis. It is this denial that any true proposition can be really synthetic which constitutes the fundamental difference between Leibnitz and Kant.

It is now further assumed (2) that every proposition is one which affirms or denies an *attribute* of a *substance* or *subject*, and (3) that there is an ultimate plurality of such logical subjects or substances. Of these assumptions (2), which is, in fact, logically a mere transformation of (1), is the source of Leibnitz's worst logical difficulties, as it forces him to hold that no proposition asserting a relation between two substances can be an ultimate truth. Any statement of the form, "A has the relation x to B," must be decomposable into a pair of statements of the form "A has an attribute x_1," "B has an attribute x_2." (3) Constitutes the only real fundamental divergence between Leibnitz and Spinoza, since according to the latter the subject of every true proposition must ultimately be the one real substance — viz., God. Leibnitz's reason for assuming a plurality of substances seems to have been his strong conviction that the human self is a real and ultimate individual.

Leibnitz goes on to observe that the whole difference between the necessary truths of science and the contingent truths of every-day experience is explained by the distinction between explicitly and implicitly analytical propositions. When writing for others, Leibnitz habitually spoke of this difference between truths of reason and truths of fact as if it were an ultimate difference in kind. Truths of reason, he usually says, depend upon the Law of Contradiction, and are therefore demonstrable; truths of fact depend on the Principle of Sufficient Reason, and are, with the one exception of the existence of God, contingent and indemonstrable. From the 'Primæ Veritates' it is clear that his real meaning was merely that truths of fact (propositions involving the assertion of existence) would require an infinitely prolonged analysis before they could be resolved into identities. Leibnitz's Law of Sufficient Reason, in fact, turns out to mean simply the doctrine that every truth is analytical and therefore capable of a priori proof, though the production of the proof may demand an infinitely prolonged analysis and thus be practically impossible for us. It now follows (1) that no two things can be exactly alike; numerical diversity always implies difference in attributes, since there must be a reason why the things are counted as two and not as one, and this reason must, on the principles just laid down, lie in some difference in their attributes. (Principle of the Identity of Indiscernibles). Hence Leibnitz denies that space is a reality, for if it were, there would be infinitely numerous real things (the points of space), which are all exactly alike. (2) There are no "external" relations between things, i.e., no relations which do not arise out of the attributes of the terms related, since every truth, reduced to its simplest terms, consists in the ascription of an attribute to a subject, and no proposition asserting relation between two things can therefore be an ultimate truth. Hence, since geometry and mechanics consist precisely in the study of such "external" relations, the whole world of extended and moving objects must be merely apparent or phenomenal, not real. (3) The true concept of any individual substance logically involves the whole series of its past, present and future states. Everything that can happen to such a substance is logically a consequence of the character of that substance, each substance is *causa sui*, the reason for the succession of its own states. Hence God, being omniscient, can deduce the whole history, e.g., of Saint Peter or Alexander the Great, from contemplation of the concept of Peter or Alexander. (4) Every individual substance involves in its concept the whole structure of the universe, so that from complete knowledge of any one substance we could deduce a priori, if our power of analysis were infinite, the whole history of the universe. This follows from the consideration that every substance stands in some relation to every other, while, according to the logic of Leibnitz, every relation presupposes as its foundation a corresponding attribute in each of its terms. Hence all the substances are different expressions of the same fundamental system. They "mirror" or "represent" the same structure but with varying degrees of clearness, like perspective drawings, taken from different points, of the same fort or city. The connection between different substances is thus ideal or metaphysical, not real or causal. Strictly speaking, no finite substance exercises a real influence on another, since every substance is the sufficient reason for the succession of its own states, and the passing over of a state or predicate from one thing into another is unintelligible. Thus what we commonly call external causes are, in truth, merely *occasions* or *conditions* of the occurrence of a change of which the real cause is always the nature of the substance in which the change takes place. But, since all substances "mirror" the same system, the result is that there appears to be causal interconnection between the states of all the things in the universe. Each thing develops from within, entirely unaffected by any other, and yet the result is the same as it would be if everything were casually affected at every moment by all the rest. This is Leibnitz's most famous theory, the doctrine of the *Pre-established Harmony* between all substances. A particular case of it is the psychophysical correspondence between the soul and the body. The soul develops independently according to the law of its own nature, and the same is true of each of the substances which, as an aggregate, compose the body, yet the correspondence between the psychical and the bodily series of changes is as complete as it would be if each series were at every step conditioned by the other, nor is there any need, after the fashion of the Occasionalists, to invoke the supernatural interference of God to effect the correspondence. The point is well illustrated by the analogy of a band of musicians who keep perfect time and tune simply because each of them is playing correctly from his own score without waiting for his cue from any of the others.

Further consequences are (5) that empty space does not exist, since it would have to consist of points which are all different, and yet all exactly alike. For the same reason, bodies do not consist, as Descartes held, of mere extension, since extension, if real, would be merely the infinite repetition of elements which are exactly alike. (6) Matter is not only infinitely divisible but infinitely divided. There are no atoms, or indivisible parts of matter. If an atom were a true substance or ultimate unit it would be theoretically possible to deduce the whole constitution of the universe from adequate knowledge of the motion of one atom, whereas in fact many different theories of the universe may agree in yielding the same series of positions for a given atom. All matter is therefore, as we read in the 'Monadology,' composite, and thus even the smallest particle is a fully organized world; every part of the «divine machine» of Nature is, in its turn, a further machine. In a word, space, motion and body, when body is defined as extended matter in motion, are not substances but merely *vera phænomena,* orderly and connected appearances of the same kind as, e.g., the rainbow; that is, they are appearances corresponding to composites or aggregates of individual substances. But, as there are no atoms, no body is really *one,* and consequently not really *many,* since «many» means a collection of ones. Thus the «corporeal substances» of the physical world must possess a «form,» or principle of unity, which is itself immaterial and analogous to our «soul.» The so-called material world must be regarded as an aggregate of immaterial units. This is why perception and volition, the fundamental attributes of the incorporeal elements, are inexplicable on mechanical principles, which only apply to composites. Hence the philosophical interpretation of the universe has inevitably to be given in terms of final causality, i.e., of the purposive activity of the ultimate simple elements.

Finally (7) since substances are simple units, no substance can begin or cease to exist bit by bit, by gradual development. The simple substance or monad, to adopt the technical term borrowed by Leibnitz from the younger Van Helmont, has no parts, and is a kind of spiritual or metaphysical «point,» and therefore can only come into existence, if at all, by instantaneous creation, and only perish, if at all, by instantaneous annihilation.

The only important doctrine of Leibnitz which does not figure in the foregoing sketch, taken from the tract on ultimate truths, is also the one doctrine which is most manifestly an excrescence on the system, the theorem of the existence of God. This is, according to Leibnitz, the only «truth of fact» which can be proved by a finite process of logical analysis. Leibnitz attempts to prove it both from a consideration of the «eternal truths» or «truths of reason,» the universals of pure science, and from the «truths of fact.» He holds, as a mathematician must, that the range of scientific truth is wider than that of actual existence. Besides the existing system of Laws of Nature, other systems are equally conceivable or logically possible, and the truths which hold for all possible constitutions of the universe form the body of «eternal truths.» But Leibnitz holds that all possibilities must be founded on something actual, otherwise there would be no means of distinguishing the possible from the impossible, a doctrine which is also fundamental in the philosophy of Lotze. The requisite foundation in actuality is provided by the existence of God. The «possible worlds» are just those systems of things which are actually present to the understanding of God. Hence the existence of God is logically necessary, provided only that it is possible, i.e., that the notion of a God or most real being involves no logical contradiction. With the addition of the proof, which Leibnitz believes himself to have given, that the existence of God is logically possible, the «ontological proof» of Descartes becomes completely valid. The existence of God may also be shown by a form of the «cosmological proof,» from the «truths of fact» which are concerned with the constitution of the actual world. There must be a sufficient reason why just this one, out of all the logically possible systems, is actual rather than any other, and this reason is found in the will of God. Volition, it is assumed, is always directed to the choice of the apparent best, which in the case of an omniscient God, is also the real best. Now the system of the Pre-established Harmony is the «best» of all possible systems for the universe, precisely because, owing to the complete adaptation of every monad in it to every other, the number of «compossibles,» that is, of substances which can co-exist as members of the same system, is greater than on any other constitution of the universe. The famous doctrine that the actual world is the best possible world thus simply means that the quantity of existence in the actual world, as measured by the number of «compossibles» is a maximum. Hence God, in virtue of the principle of the choice of the best, chooses that this system rather than any other possible arrangement should exist. It is not clear how this act of choice is to be understood, nor does Leibnitz help us much by the curious conception that every possible system tends or strives to become actual with a force proportionate to the amount of reality, i.e., the number of «compossibles» it comprises, and that God's creative activity consists in removing from the actual world the hindrance to existence which would otherwise arise from the rival tendencies of the possible worlds to existence. If «existence» is logically a predicate, it ought, on Leibnitz's principles, to be inherent in the nature of the subject to which it belongs, and the actual world should thus exist eternally and necessarily. If it is not a predicate but an «external» relation imposed on the particular system of the Pre-established Harmony by the will of God, the doctrine of the analytic character of truth, from which the system of Pre-established Harmony is a mere deduction, must be false, and, as a further complication, the «ontological proof» of God's existence must also be worthless. It must be noted that God is not a monad, but stands quite outside the system. The common statement that Leibnitz spoke of God as the «monad of monads» seems to originate with Hegel and to have no foundation.

In the «Monadology» and the writings connected with it the consequences of the system are developed with particular reference to their bearing upon the nature and destiny of the soul. Every monad, or simple substance, is an incorporeal unit possessing a capacity of adaptation to the simultaneous condition of other monads which is called *perception,* and a tendency to spontaneous internal change of state, which is called *appetition.* An organism is a cluster of such monads, the states of which are more readily seen to be adapted to one another than they are to those of any other monads. In Leibnitz's language, each member of the cluster «perceives» or «represents» the rest more clearly and with less confusion than it does any other monads. In each such cluster there is a dominant monad, analogous to a soul, which «represents» the rest with special clearness, and in which it is, in consequence, particularly easy to discover the reasons for the succession of states in the others. In virtue of the finitude of every monad, however, there is in every monad some element of confused perception, or «passivity,» i.e., there are some changes of state in every monad the reasons for which cannot be discovered by us in the monad itself, but have to be found by considering other monads. Hence Leibnitz infers that no soul or dominant monad is ever completely devoid of a body or system of associated inferior monads. This element of limitation or confused perception is called «metaphysical evil,» and is treated as the source both of suffering, or *physical,* and of wrongdoing or *moral,* evil.

The system of monads now falls into a hierarchy of three grades, according to the degree of the monad's clearness of perception. The perception and appetition of the monad are not necessarily conscious. The condition of the monads which compose the so-called inanimate world is similar to that of the soul in profound sleep or swoon; their perceptions are, as we now say, permanently «below the threshold» of distinct consciousness. Leibnitz is thus the author of the doctrine since so fateful in Psychology, of indefinitely minute «unconscious» mental modifications. In animals, when fully developed, the formation of sense-organs, which are essentially an apparatus for the collection of stimuli, renders possible the summation of such «minute perceptions» to form a single intensified and therefore conscious perception, and thus provides a basis for memory and association. Those «dominant monads» which have thus been furnished with heightened perceptions form the second stage in the hierarchy, that of animal souls. In accord with the biological ideas of his time, Leibnitz regards the process of conception and birth essentially as one of development in size; not only is there no generation of life from lifeless matter, but each living germ, even before conception, already contains, on a microscopic scale, the whole organization of the future animal. Death is the converse process of reduction, by which the organism returns to a microscopic condition; hence, strictly speaking, not only all souls, or dominant monads of organisms, but all organisms themselves, are indestructible. Rational minds form the third and highest grade in the system of monads. Their distinguishing characteristic is that, in addition to memory and the power of forming associations of ideas, they possess the power of discerning rational connections between truths, and thus of rising to reflective consciousness of the *self* as a simple substance and of God, the infinite substance. Since the perceptions of every monad are internal states of itself, Leibnitz necessarily agrees with Descartes in regarding the fundamental notions of rational science as *innate,* but is more careful than Descartes to give prominence to the necessity for analysis and reflection before these innate ideas can be brought to light. Before the reflective process has disengaged them the fundamental categories of rational thought are present in the mind as veins, which have not yet been laid bare, are present in the unshaped block of marble. In virtue of their capacity for rational thought, spirits may be said to be living mirrors not only of the universe, like all other monads, but of God, its cause. God is related to them not merely as to all created things, after the fashion of an inventor to his machine, but as a prince to his subjects or a father to his children. Thus they form, within the universe, a more special society or «city of God» over which God presides not merely in accordance with natural but also in accordance with moral law. The universe thus presents, within the Pre-established Harmony itself, a second harmony between the physical and moral orders in consequence of which the mechanical sequence of physical causes and effects tends of itself, without any need for special divine interposition, to an ultimate adjustment of the happiness of each spirit to its moral deserts. Leibnitz's mathematical optimism thus culminates in ethical optimism at the cost of a rather hazardous identification of goodness in the metaphysical sense of quantity of existence with goodness in a specifically moral sense.

Two points still call for some further remark: (1) Leibnitz's conception of matter; (2) his ethical theory.

Matter.—Leibnitz's theory of matter is conditioned by his discovery of the fundamental defect of Cartesian Mechanics. Descartes had assumed that «quantity of motion,» or momentum, is independent of the direction of motion, and had consequently been led to base his Mechanics on the assertion that the quantity of motion in a dynamical system remains constant. Against this view Leibnitz contended that the capacity of a moving body for doing work, its *vis viva* or «living force,» as measured by its effects in moving another body through a greater or a less distance, is proportional not to its momentum, but to its momentum multiplied by its velocity. Hence the correct measure of force is not mv (momentum) but mv^2 (*vis viva,* the double of what we call the Kinetic energy of the body). It is this which is really conserved in dynamical transactions between bodies. (The controversies as to the true «measure of force» to which these observations gave rise have long been admitted to be largely verbal. If we measure a constant force by the momentum it generates in a given time, Descartes' formula is, of course, correct; if we measure it by the distance through which it propels a body, that of Leibnitz has to be adopted. Similarly, both the Conservation of Momentum and the Conservation of Vis Viva, if properly formulated, are truths). The importance of the point in Leibnitz's philosophy is due to the fact that it led him to regard force as a real entity, different from actual motion, and thus to hold, as against the Cartesians, that the phenomenal physical world cannot be analyzed into extension and motion alone. For Leibnitz's own theory of phenomenal matter it is further important to distinguish *primary* from *secondary matter*. Primary matter itself is something more than mere extension or occupation of space. It is extension plus resistance (a conception which seems to combine in one inertia and impenetrability). But for this quality of resistance any one state of the physical world would be indistinguishable from any other. Primary matter is however purely passive, and is never to be found existing alone. All physical existents contain in addition force, in the sense of spontaneous tendency to change of state. It is the secondary matter thus constituted by extension *plus* resistance *plus* force which is studied by the physicist, and held by Leibnitz to be infinitely divided and organized. Secondary matter thus stands, so to say, halfway between the monads and the pure abstraction of primary matter, and is the matter of which Leibnitz speaks as a "truthful phenomenon." There is really no very close connection between these dynamical theories and the metaphysical system of Leibnitz, though the two are made to look more intimately related than they actually are by a confusion between force in the dynamical sense of rate of change of momentum and force in the metaphysical sense of the inherent tendency of the monad to change of state.

Ethical Views.— There is nothing very individual in the ethics of Leibnitz (which may be generally described as a doctrine of rationalistic utilitarianism of a type common enough in the 17th and early 18th centuries), except his treatment of the problem of moral freedom. As we have seen, the original source of all change is appetition in the monad. Conscious appetition is desire, and desire is always directed toward the apparent best. There is thus no such things as unmotived willing; a volition only seems unmotived when the motive impulse is "below the threshold." Leibnitz is consequently a consistent determinist in his analysis of choice and volition, yet he regards it as one of the merits of his system that it vindicates the reality of freedom against the Spinozistic doctrine of universal necessity. In what sense, then, are we free? Leibnitz replies by distinguishing two kinds of necessity, metaphysical and moral. That is metaphysically necessary of which the contradictory is impossible. In this sense no volition is necessary. (This, however, is, of course, inconsistent with the theory that all true propositions are analytical, since the contradictory of an analytical proposition must be false). A thing is morally necessary when it is an indispensable means to the obtaining of the apparent best. In this sense all volitions are necessary— though for reasons which merely incline, but do not compel the will. Spinoza, according to Leibnitz, erred by confusing the two senses of necessity. Moral freedom, then, consists in spontaneity plus intelligence. We are free in proportion as we have intelligence to discern the real best, a doctrine which is only nominally distinct from Spinoza's. Leibnitz further agrees with Spinoza in his general conception of the moral good. Pleasure is assumed to accompany increase of activity, i.e., clear perception, and good and evil correspond to acts motived respectively by clear and by confused perception. Hence Leibnitz ought to have regarded vice as equivalent to honest and unavoidable error. He tries to escape by his distinction between metaphysical and moral evil. The former is simply the element of passivity or confused perception in the monads, and is not inconsistent with God's goodness, since a world which includes this element may contain a greater number of "compossibles," and so be on the whole better, than one which does not. Moral evil, or vice, and physical evil, or suffering, are inconsistently regarded at once as being logical consequences of this metaphysical evil, and yet as contingent and non-necessary. The ethical system based on such ideas is naturally in the main one of enlighted egoism in which intelligence is exalted at the cost of ignorant good intentions. But since, in virtue of the harmony between monads, my own good and that of others are inextricably bound up together, Leibnitz holds that doing good to others naturally gives us pleasure, and hence he agrees with Shaftesbury in recognizing the existence of disinterested affection. To make the coincidence of my own good with the good of others complete he has further to assume, as we have seen that he does, immortality and the final proportionment of happiness to desert.

Other works by Leibnitz are 'Nouveau système de la nature' (1695); 'Essais de théodicée' (1710); 'Principes de la nature et de la grâce' (1714); 'Nouveaux essais sur l'entendement humain' (1765). His philosophical works in French and Latin have appeared in several editions. The principal are those of Erdmann (Berlin 1840), of Jaret (Paris 1866; 1900); and of Gerhardt (Berlin 1875–90). Pertz undertook the publication of a complete edition — four volumes of history (Hanover 1843–47), seven volumes of mathematics (Berlin and Halle 1849–63) and one volume of philosophy have appeared. Some of the important philosophical works have been translated by G. M. Duncan (New Haven 1890); the 'Nouveaux essais' by A. G. Langley (London 1894); 'The Monadology' by R. Latta (Oxford 1898).

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1876); Merz, J. T., ‘Leibnitz’ (London 1884); Nourrisson, J. F., ‘La philosophie de Leibniz’ (Paris 1860); Pfleiderer, Edmund, ‘G. W. Leibniz als Patriot, Staatsmann und Bildungsträger’ (Leipzig 1870); Russell, B. A. W., ‘Critical Exposition of the Philosophy of Leibnitz’ (London 1900); Zimmermann, Robert, ‘Leibnizs Monadologie’ (Vienna 1847).

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LEICESTER, Robert Dudley, EARL OF. See DUDLEY, ROBERT, EARL OF LEICESTER.

LEICESTER, lĕs'tėr, England, county-town of Leicestershire, on the river Soar, a southern tributary of the Trent, 99 miles northwest of London, on the Midland Railway and on branches of the Great Northern and London and Northwestern railways and on the Leicester Canal. It was the Roman *Ratæ* and the ancient British and Roman *Ratæ Coritanorum* and has interesting Roman remains, including the Jewry wall and several pavements, while the bricks in the early Norman church of Saint Nicholas are of Roman origin. There are several fine churches with Norman and early English remains and the ruins of an abbey of the Black Canons, founded in 1143. The castle has parts of the original Norman hall, two gateways and an artificial mount upon which the donjon or keep stood. It was one of the «Five Boroughs» of the Danes in the 9th century. It was a municipality in 120–121 A.D., was the seat of a bishopric in 680–874 and in the 13th century it instituted a government by a mayor and 24 jurats. It was taken by storm by Charles I in May 1645 and retaken by Fairfax in the following month. It was granted its first charter by Robert of Meulan in 1103 or 1118 and later received charters by Henry VII in 1505, by Elizabeth in 1599, by James I in 1605 and 1610, by Charles I in 1630 and by James II in 1684. It has been represented by two members in Parliament since 1295. It has a prescriptive market dating from the 13th century, held on Wednesdays and Saturdays; a fair dating from 1228, and another dating from 1473. There are several other fairs of more recent origin. There are excellent modern libraries, schools, hospitals, benevolent institutions, art museum, gymnasiums, churches and parks. It became a county borough in 1892 and was extended to constitute a civil parish in 1892. The manufacture of hosiery on knitting frames was established about 1680 and still constitutes an important industry. The manufacture of boots was introduced in the 19th century and the brewing and woolen industries were established in the 13th century. Other industries include the manufacture of cotton, lace, elastic webbing, iron-works and brick-works. Pop. about 227,242. Consult Bateson, ‘Records of the Borough of Leicester’ (1899); Johnstone, ‘History of Leicester’ (1892).

LEICESTER, Mass., village in Worcester County, six miles southwest of Worcester, at the sources of the Quinebaug River and on the Boston and Albany Railroad. It is situated in a fertile, well-wooded farming district and manufactures cards, clothing and woolen goods. Pop. 3,237.

LEICESTER, or THE FATAL DECEPTION, a tragedy written by William Dunlap (q.v.) in 1794 and credited with being the first tragedy of American authorship to be produced on the stage.

LEICESTER SQUARE (formerly LEICESTER FIELDS), London, England, a square in the west end of the city; frequented by foreigners of the middle class, especially French and a refuge for the French Huguenot émigrés after the Edict of Nantes in 1685. It was uninclosed country until the time of Charles II. It was once the site of Savile House; and Leicester House, built for Robert Sidney, Earl of Leicester, formerly stood on the north side of the square. Here Queen Elizabeth of Bohemia, «the Queen of Hearts,» died 13 Feb. 1662, and Frederick, Prince of Wales, also died in Leicester House in 1737. Hunter, Hogarth, Newton and Reynolds once lived in the neighborhood.

LEICESTERSHIRE, England, north midland county, bounded by Derby on the northwest, Nottingham on the north, Lincoln and Rutland on the east, Northhampton on the southeast and Warwick on the southwest, where it likewise touches Staffordshire. The area of the county is 819 square miles. The surface is undulating, the hills of the Charnwood Forest in the northwest forming the highest ground, Barden Hill having 912 feet elevation. The county drains chiefly to the Trent through the Soar, Anker, Devon and Mease; but the south of the county drains to the Avon. The climate is mild and rainfall moderate; the soil of a loamy quality, of which nine-tenths is under cultivation. Dairying is an important industry and the famous Stilton cheese is manufactured near Melton Mowbray. It is a famous fox-hunting county, Leicester and Melton Mowbray being the principal centres, while the noted kennels of the Quorn Hunt are at Quorndon, near Mount Sorrel. Coal mining is carried on extensively and there are quarries of limestone, freestone, blue slate and granite. The Leicester sheep are famous for their fine fleeces, the wool being largely used in local manufactories of wool hosiery. The district was penetrated by the Anglians in the 6th century and Leicester fell to them about 556. It formed the kingdom of the Middle Angles in the kingdom of Mercia in 679, and in the 9th century was conquered by the Danes. The earliest inhabitants were the Celtic Coritani, who were conquered in turn by the Romans, Anglians, Danes and Normans. The Domesday Survey of 1086 reveals the landholders of the district to be chiefly Norman. Leicester was a Lancastrian stronghold during the Wars of the Roses and was the scene of the battle of Bosworth in 1485. In the Civil War of the 17th century Leicesteshire favored Parliament in the main. Lady Jane Grey was born at Bradgate, near Leicester. The woolen industry was important as early as Norman times and Leicestershire wool commanded a higher price than any in England in 1343. The manufacture of hosiery was inaugurated in the 17th century and continues of prime importance. Pop. 432,019.

LEICHHARDT, lĭk'härt, **Friedrich Wilhelm Ludwig,** German explorer: b. Trebatsch, Brandenburg, Prussia, 23 Oct. 1813; disappeared in Australia, 1848. He was educated at the universities of Göttingen and Berlin, specializing in philology and natural history, and in 1841 went to Australia where he was engaged in making a geological survey, the reports of which were published after his death. His second visit to Australia was at the head of an exploring expedition in which he traversed Queensland and Arnhem Land in 1844–45 and traveled some 2,000 miles. In 1848 he started from Moreton Bay in an attempt to traverse the continent and was lost, the last communication received from him being despatched from Macpherson's Station on Cogoon River, 3 April 1848. Five relief expeditions were organized and sent in search of him in 1851–65 but no trace of him was found. A town and county were named in his honor in New South Wales as well as a district in Queensland. Author of 'Journal of an Overland Expedition in Australia, from Moreton Bay to Port Essington' (1847); 'Contributions to the Geology of Australia' (1855).

LEIDENFROST, lī'dĕn-frōst, **Johann Gottlob,** German scientist and professor of medicine: b. Rosperwenda, 24 Nov. 1715; d. Duisburg, 2 Dec. 1794. He studied at Giessen, Leipzig and Halle and from 1743 until his death he was professor of medicine at the University of Duisburg. He was the originator of an experiment proving the spheroid shape of a drop of water by dropping it upon a hot plate and demonstrated the presence of a layer of vapor between the plate and the water. Author of 'De Aquæ Communis Nonnullis Qualitatibus' (1796); 'Opscula Physico-Chemica et Medica' (1797).

LEIDY, lī'dĭ, **Joseph,** American naturalist: b. Philadelphia, 9 Sept. 1823; d. there, 30 April 1891. He was graduated M.D. at the University of Pennsylvania in 1844 and in 1853 was elected to the chair of anatomy in that institution, a post which he long filled, as well as that of professor of natural history in Swarthmore College, Pa., to which he was appointed in 1871. In 1881 he became president of the Academy of Natural Sciences at Philadelphia and in 1885 president of the Wagner Free Institute of Science in that city. He was the author of many valuable memoirs, chiefly published in the *Proceedings* of the Academy of Natural Sciences, the *Transactions* of the American Philosophical Society and the 'Smithsonian Contributions to Knowledge.' Among them may be cited 'Ancient Fauna of Nebraska' (1853); 'Cretaceous Reptiles of the United States' (1865); 'Fresh Water Rhizopods of North America' (1879); 'Treatise on Human Anatomy' (1861–89). Consult the Memoir by Chapman, H. C., in the *Proceedings* of the Academy of Natural Sciences (1891).

LEIGH, lē, **England,** market town and municipal borough in Lancashire, 11 miles northwest of Manchester, on the London and Northwestern Railroad. The town has a church dating from 1279 which, with the exception of the tower, was restored in 1873. There is an amply endowed grammar school of unknown age, but which received its heaviest endowments in 1655, 1662 and 1681. The town was founded in the 12th century, but not incorporated until 1899. Its officers consist of a mayor, 18 aldermen and 24 councilors. The municipal equipment in gas, water, sewage disposal, hospital and fire departments is modern. The town is situated in a coal-mining region, manufactures silk and cotton goods and has extensive collieries; it has also breweries, flour mills, glass works and foundries. Pop. 44,103.

LEIGHTON, lā'tŏn, **Alexander,** English physician and clergyman: b. Scotland, 1568; d. London, 1649. He was educated at Saint Andrew's University, became a Presbyterian clergyman and settled in London where he engaged in the practice of medicine in addition to his work as a preacher. He became involved in difficulties through his publication in 1624 of 'Speculum Belli Sacri, or the Looking-Glass of the Holy War' and his petition to Parliament against episcopacy which he afterward enlarged and published in Holland, 'An Appeal to the Parliament, or Zion's Plea against the Prelacie' (1628). These writings were violent in their abuse of the bishops, the king and particularly of the queen. He was seized by the authorities 17 Feb. 1630, sentenced to be degraded from holy orders, pay a fine of £10,000 and to life imprisonment after being whipped, pilloried, branded and mutilated. He succeeded in making his escape but was recaptured and part of the sentence of mutilation was executed with the utmost barbarity, although for some reason the second half of the punishment was remitted. He was then imprisoned until 1640 when the Long Parliament remitted his fine and voted him £6,000 for his losses and injuries. In 1642 he was made keeper of the state prison, Lambeth House, where in shattered health he spent the remainder of his life. Archbishop Laud is credited as chiefly responsible for the inhuman persecution of Leighton.

LEIGHTON, Frederick, Baron, English painter: b. Scarborough, 3 Dec. 1830; d. London, 25 Jan. 1896. He received some lessons in art at Paris as early as 1839, and then followed further instruction at Rome. At 14 he entered the Royal Academy of Berlin and subsequent art studies were made by him at Frankfort, Brussels and Paris (1850). From Rome he sent to the Royal Academy exhibition of 1855 his picture of 'Cimabue's Madonna Carried Through Florence'— a work which called forth general admiration and was purchased by the queen. He resided mostly in Paris for the next four years, studying and painting, and to this period belong, among other works, 'The Triumph of Music' (based on the story of Orpheus and Eurydice); 'The Fisherman and the Siren' and 'Romeo and Juliet.' Having finally settled in London, he was elected in 1863 an associate of the Royal Academy, and in 1869 a full academician. In 1878 he succeeded Sir Francis Grant as president of the Royal Academy, was knighted and was also named an officer of the Legion of Honor. In 1886 he was created a baronet and in 1896 was raised to the peerage. From among his numerous works may be singled for special mention 'Paolo and Francesca' (1861); 'Jezebel and Ahab' (1863); 'Orpheus and Eurydice' (1864); 'Hercules Wrestling with Death' (1871); 'Elijah in the Wilderness' (1879); 'Hero Watching for Leander' (1887); 'Captive Andromache' (1888); 'Greek Girls

Playing at Ball' (1889); 'The Bath of Psyche' (1890); 'Lachrymæ,' now in the Metropolitan Museum, New York; as also the two large frescoes at the South Kensington Museum, representing respectively the 'Arts of War' and the 'Arts of Peace.' He achieved a high place as a sculptor by his 'Athlete Strangling a Python' (1876) and his 'Sluggard' (1886). The special merit of his work lies in the perfection of his draftsmanship and design; his coloring, though possessing the unfailing charm of harmonious arrangement, is only thoroughly satisfactory from the decorative point of view. A fine poetic quality conjoined with elegance in drawing and great refinement in execution mark his whole work. His 'Addresses to the Students of the Royal Academy' appeared in 1896. Consult 'Lives' by Mrs. Lang (1885); Rhys (1895); Monkhouse, 'British Contemporary Artists' (1899).

LEIGHTON, Robert, Anglican archbishop, son of Alexander Leighton (q.v.): b. probably London, possibly Ulishaven, Forfarshire, 1611; d. London, 25 June 1684. He took his A.M. at the University of Edinburgh in 1631 and afterward traveled in France, acquiring the language, and through his association with relatives of Roman Catholic faith, a broad religious tolerance which remained a dominating characteristic all his life. He apparently returned to England after his father's pardon in 1640, and in 1641 he was ordained a Presbyterian clergyman at Newbattle, Midlothian. He resigned his charge in the following year, finding himself unable to co-operate with the fiery zeal of his associates. In 1653 he became principal of the University of Edinburgh and primarius professor of divinity, where he remained seven or eight years. His addresses and prelections of that period evidence an exceptionally cultivated mind and a high spiritual elevation. When, after the Restoration, Charles II determined to bring Scotland again within the fold of Episcopacy, he selected Leighton as one of his bishops. While long severed from his connection with the Presbyterians, Leighton was averse to accepting the appointment, but was persuaded in the belief that the Episcopacy contemplated was of the liberal order advocated by Archbishop Ussher and which he was sure the more liberal non-conformist leaders would accept. He chose the diocese of Dumblane and administered its affairs with exemplary mildness. His associates, however, were if anything more intolerant than those he had left in the Presbyterian ministry and the persecutions inflicted upon the Covenanters induced him to go to London in 1665 with the purpose of resigning his bishopric. Receiving from Charles II the promise of milder methods Leighton returned to his charge, but finding no results from the promises made he returned to London in 1669 again to plead for milder methods of spreading the religion he consistently believed to be the best but which was being injured by the usages in force. Promises were again forthcoming and in the following year there appeared a slight effort to carry them out, so that Leighton, upon being promised co-operation in the conciliatory measures he deemed advisable, accepted the archbishopric of Glasgow. He occupied this post in 1670–74, when, despairing of inducing his colleagues to depart from their immoderate courses, and finding himself with both the Episcopalians and Presbyterians as antagonists, he resigned. He lived thereafter with his sister at Broadhurst in Horsted Keyes, Sussex. His writings were collected and published after his death, but have suffered from over-editing. The best edition is considered that of Rev. W. West (7 vols., 1869–73), which includes a biography of Leighton. Consult also Burnet, 'History of His Own Times' (1723–24); Lang, Andrew, 'History of Scotland' (1902).

LEINSTER, lĕn'stẽr, Ireland, one of the four provinces of Ireland, occupying the middle and southeastern portion of the island, extending to the river Shannon and bounded on the east by Saint George's Channel and the Irish Sea. Its boundaries include counties Carlow, Dublin, Kildare, Kilkenny, King's, Longford, Louth, Meath, Queen's, West Meath, Wexford and Wicklow. The southern part formed the ancient kingdom of Leinster (*Laighen*), while the northern region was the kingdom of Meath. The area is 7,622 square miles and the population, which declined from 1841, is now increasing. Pop. 1,162,044.

LEIPA, or **BÖMISCH-LEIPA**, bė'mĭsh lī'pạ, Austria, city of Bohemia, 23 miles southwest of Reichenberg and 42 miles northeast of Prague, on the river Polz. Its population is chiefly of German origin and it is important industrially. It has woolen spinning-mills, sugar refineries, breweries and railroad machine-shops; and manufactures velvet, cotton cloth and pianos. Pop. 13,493.

LEIPZIG, lip'tsĭg, or **LEIPSIC**, lip'sĭk, Germany, the largest town of Saxony and the third largest in the German Empire, situated in a broad, fertile plain at the confluence of the rivers Elster, Pleisse and Parthe. The city comprises the inner town, the inner and outer suburbs (Vorstädte), the more outlying suburbs (Vororte), incorporated with the city in 1889–92, and more recent extensions since 1910, all traversed and connected by electric street railroads. The former fortifications surrounding the inner city have been replaced by fine streets and promenades. The old city still retains much of its ancient appearance, but the modern suburbs are characterized by broad streets and imposing buildings. Among the squares of the city are the Marktplatz, with a Siegesdenkmal; the Augustusplatz, one of the largest in Germany, with a splendid fountain; the Königsplatz, the Johannisplatz, with a Reformation monument (Luther and Melanchthon); and the Rossplatz; and among the other monuments worthy of mention are those of Gellert and Fechner in the Rosenthal, an extensive park in the northwest, between the Elster and the Pleisse; of Hahnemann, Leibnitz, Grassi, Mendelssohn and Bismarck; together with the more recent memorial of the Völkerschlacht. Besides the parks and open spaces just mentioned, Leipzig includes, among many others, the Johannapark, the Grassipark; the König Albert Park, the scene of the 1897 exhibition; the Johannisthal, with an observatory; the botancal garden; the zoölogical garden, recently much extended; the palm garden, opened in 1899. The most noteworthy churches of the city are the Thomaskirche (13th century), rebuilt 1885–89, in which Bach was organist; the Nikolaikirche (11th century), recently restored; the University or Paulinerkirche (1240), restored 1896–99; the Matthäikirche, restored 1879; the Johanniskirche (14th century), rebuilt and reconsecrated in 1897, and containing the remains of Sebastian Bach and Gellert; the Peterskirche; the Lutherkirche; the Andreaskirche; two modern Roman Catholic churches; an Anglo-American church; a synagogue; and churches of other denominations. Of non-ecclesiastical buildings the most notable are those of the university, which was founded in 1409, is now the third largest university in the German Empire and has over 5,000 students. The 500th aniversary was fittingly celebrated in 1909. These buildings are mostly modern, especially the Albertinum, erected in 1890–96 in accordance with the plans of A. Rossbach for completing and renewing the whole group. The university library (the Albertina) contains 600,000 volumes and over 6,000 manuscripts. Other buildings and institutions are the old Rathaus (16th century); the new Rathaus, in course of construction on the site of the Schloss Pleissenburg, a 13th century building, once the citadel of the town and famous as the scene of Luther's disputation with Eck in 1519; the old exchange (1678), now the meeting-place of the town council; the new exchange in Renaissance style; the Königshaus (17th century), the residence till 1829 of the Saxon princes; the old Gewandhaus, where the celebrated Gewandhaus concerts were long held; the new concert hall; the Imperial Bank building, in German Renaissance style; the municipal library (1899), containing 130,000 volumes and many manuscripts; the municipal museum, in Italian Renaissance style; the chief post-office; the new book exchange, the headquarters of the German book trade, in German Renaissance style; the Buchgewerbehaus (1897), with a Gutenberg hall; the panorama building; the Grassi Museum (1896), now including the collections of the former museums of industrial art and ethnology; the building of the Land und Amtsgericht, enlarged in 1895–96; the Imperial-Supreme Court; the new conservatory of music; the old and the new theatre; the Krystallpalast, including concert halls, etc.; the market hall; the large Johannis hospital; a deaf and dumb and a blind institution; the hospital of Saint Jakob; the Triersches Institut, for women; three gymnasia, namely, the Thomasschule (1221), the Nikolaischule (1511) and the Royal Gymnasium, a Real Gymnasium; several Realschulen and many other schools; a Handelshochschule, or High Commercial School (1898), the first in Germany; the new normal college for women (1912); a school of industrial art; a Royal Academy of Arts; and the new infantry barracks at Möckern. Chief among literary associations is the famous Auerbach's Cellar, introduced in Goethe's ‹Faust.› Leipzig has railway communication with all the chief towns of Germany and its situation makes it of great importance as a trading centre. The new railway station covers the largest area of any in Europe. It has three large annual fairs, which have been held ever since the 12th century. It is the headquarters of the book trade in Germany, having no fewer than 100 book-selling and publishing firms, and takes a foremost place among European towns in the many industries associated with the publication and printing of books. Its other industries include iron-founding, cotton-spinning, wool-combing, the weaving of jute and linen, brewing, sugar-refining, distilling and the manufacture of machinery, electrical plant, agricultural implements, ethereal oils, dyes, essences, soaps, perfumes, wax-cloth, chocolate, tobacco, paper, leather, tapestry, cement, musical and other instruments, etc. Leipzig is also a world market for furs and all similar goods.

The municipality, governed by an over-burgomaster, burgomaster, police director, magistrates and councilors, is most progressive, gas, waterworks and electricity being in its hands, and there is a municipal bakery. The name Leipzig, from the Slavonic *lipa*, a lime-tree, is found applied to a Slavonic fishing village near the present site of Leipzig about 1017. The history of the town during many centuries is one of gradually extending importance. It suffered much during the Thirty Years' War at the hands of both combatants. Its position of pre-eminence in the book trade dates from the latter half of the 17th century. During the earlier years of the 18th century the town became the centre of a literary movement under Gottsched. Leipzig and its neighborhood suffered greatly during the Napoleonic wars and on 16–19 Oct. 1813 a series of severe battles fought around the town resulted in a crushing defeat of Napoleon and the retreat of the French from Germany. This victory was commemorated by the unveiling, on the centenary of the battle in 1913, of a colossal monument 300 feet high, designed by Professor Bruno Schmidt and costing $1,500,000. During the war of 1866 Leipzig was occupied by Prussian troops for 18 months. In 1879 the Supreme Court of Justice for the empire was established in the city. Since 1880, when the population, in which Protestants overwhelmingly preponderate, was 149,081, the population has remarkably expanded, being 357,122 in 1890, 456,124 in 1900, 589,850 in 1910 and (with recent suburban extensions) was estimated in 1914 at 626,267.

LEIPZIG, Battles of, three important battles, two of which were in the Thirty Years' War, and one in the Napoleonic Wars. (1) The first battle of Leipzig is also known as the battle of Breitenfeld from the plain about a mile from the city, upon which it was fought. It was fought 17 Sept. 1631 between the Swedes under Gustavus Adolphus and the Imperialists under Tilly. The forces of the Imperial army were estimated at 44,000 men; while the Swedes, with whom were allied the Protestant Saxons under Elector John George I, had altogether about 20,000 men. The Imperialists were defeated with losses variously reckoned as from 7,000 to 10,000 men, while the allied Swedish and Protestant Saxon troops lost 2,700. The battle is important from the military point of view in its exemplification of the prime necessity for mobility; and from the historical viewpoint as constituting the first signal advance of Protestant forces against the hitherto impregnable forces of Catholicism. (2) The second battle of Leipzig was fought 2 Nov. 1642, and is also called the second battle of Breitenfeld. The Imperialists of Austria, under Leopold of Austria and Piccolomini, were defeated by the Swedes under Torstenson. (3) The most important battle of Leipzig is the victory gained by the allied armies of Prussians, Russians, Austrians and Swedes under the command of Prince Schwarzenberg against the French forces under Napoleon. The battle was fought 16–19 Oct. 1813 and practically secured the liberty of Germany, where it is called «Völkerschlacht» («the Battle of the Nations»), owing to the number of nationalities involved in the two armies

At the outset of the battle the allied army numbered about 200,000, which was later increased to 300,000. Napoleon had, all told, about 180,000. Napoleon personally directed the battle, which at first went in his favor, and was lost only through the inability of Marshal Ney to furnish him with reinforcements; Napoleon failed to make use of an opportunity to effect a retreat by way of Lindenau on 17 October, a Sunday, and in falling back on the two succeeding days was subjected to heavy losses. Of his forces 40,000 were killed or wounded and 30,000 taken prisoner. The allied losses were about 54,000. The battle, aside from its constituting a decisive victory is important as marking the point from which the downfall of Napoleon became assured. Consult Gerlach, L., 'Die Schlacht bei Leipzig' (1892); Maude, F. N., 'The Leipzig Campaign, 1813' (1908); Jomini, H., 'Life of Napoleon' (Vol. IV, 1864).

LEIPZIG, Colloquy of, conference held in Leipzig by the German Lutherans and Calvinists 3–23 March 1631 for the purpose of securing harmony between the two churches, and a resultant union to resist the execution of the Edict of Restitution. The Landgrave, William of Hesse, the Elector Christian William of Brandenburg and the Elector John George met at Leipzig accompanied by their leading theologians Johannes Bergius, Theophilus Neuberger and Johannes Crocius of the Reformed faith, and Matthias Hoë, Polycarp Leyser and Heinrich Höpffner of the Saxon Lutherans. The Reformed party proposed the Confession of Augsburg as a basis of discussion, announcing their willingness to sign it as it stood in the Saxon form published by Elector John George of Saxony (1628). The articles of the Confession were taken up separately and unanimity of opinion was found to exist on articles v–vii and xii–xviii, and their differences on i–ii were declared immaterial. The third article, on Christology, found a wide difference of opinion, and they compromised on a definite statement of their separate beliefs. The Lutherans maintained that the human and divine natures of Christ were identical in possessing omniscience and omnipotence, while the Reformed party denied that Christ as a man possessed these attributes. They agreed on the fourth article, the Reformed theologians confirming the Lutherans in their belief that Christ did not come to save all men; and on the ninth article, concerning baptism, they also agreed after making some additions. Upon the tenth, however, an agreement was found impossible and it was treated in the same manner as the third. The Reformed party maintained that participation of the blood and body of Christ in the Eucharist is by faith while the Lutherans held to the belief of actual physical participation. The remaining articles were agreed to, and as the conference was private, only four copies of the protocol were made, one for the faculty of Leipzig and one for each of the princes patronizing the meeting. Later, however, reports of the conference were published in England, France, Switzerland, Holland and Sweden. While the meetings were conducted in an amicable spirit and many close points of agreement found, the conference had no lasting results in the way of closer understanding or union.

LEIPZIG, University of, third largest and second oldest university in Germany, founded in 1409 by 400 students and 40 teachers, who seceded from the University of Prague as an outcome of the Hussite agitation, and the decree which transferred the power of the university from the Germans to the Bohemians. The statutes and constitution closely follow those of Prague, and the university was founded under the patronage of Frederick the Quarrelsome of Meissen and his brother William. It flourished until 1559 when its standards were lowered, and failed to make much progress until 1830 when a reorganization was effected. The university thereafter became one of the most important in the world, and for a time it enrolled the largest student body in Germany, although those of Berlin and Munich have now exceeded it in that respect. It is fortunate in possessing large revenues from house property in Leipzig and great estates throughout Saxony in addition to substantial assistance from the state. Its professorial chairs are handsomely endowed. The buildings are in the main modern, a series of building operations in 1890–96 co-ordinating and renewing the entire group. Especially notable among them are the library with nearly 600,000 volumes and more than 6,000 manuscripts, the legal and the philosophical faculty buildings. A change was made in the governing organization of the university in 1893, the new body being called the «syndicate.» Before the outbreak of the European War in 1914 it enrolled a student body of more than 5,000 in medicine, law, theology and philosophy.

LEIPZIGER, Henry Marcus, American educator: b. Manchester, Eng., 29 Dec. 1853; d. New York, 1 Dec. 1917. Coming to New York in 1865, he was educated in the City College and Columbia (Ph.D. 1878), taught in the public schools (1873–81), was assistant superintendent of schools (1891–96), superintendent of lectures for board of education (1890–96), and from 1896 to his death supervisor of public lectures. He was identified for some years with the Aguilar Free Library, Hebrew Technical Institute and the Y. M. H. A.

LEISHMAN, John G. A., American diplomat and iron manufacturer: b. Pittsburgh, Pa., 28 March 1857. He was orphaned at an early age and entered the steel industry at Pittsburgh, learning the business in all its intricacies. He succeeded in accumulating a considerable fortune, was senior member of the steel-brokerage firm Leishman and Snyder in 1881–86, and vice-president of Carnegie Brothers and Company from 1887 until 1897, when he became president of the firm in its reorganized form as the Carnegie Steel Company. He shortly afterward retired from business. He accepted the appointment as Minister to Switzerland from President McKinley in 1897, where he remained until his transfer to Turkey in 1900. He particularly distinguished himself for diplomatic tact and dexterity in his negotiations with Turkey for full rights for American citizens and schools in that country, and in his pressing with equal success his insistence that the American Minister should have access to the Sultan. His office was elevated to the rank of Extraordinary Ambassador and Plenipotentiary in 1906 and he continued service in Turkey until President Taft appointed him to the Embassy in Italy in 1909. From 12 Aug. 1911 to 4 Oct. 1913 he was Ambassador to Germany.

LEISLER, lĭs'lẽr, **Jacob,** American colonial political leader: b. Frankfort-on-the-Main, Germany; d. New York, 16 May 1691. He came to America as a private soldier in the service of the Dutch West India Company, and was for a time engaged in trade at Albany, and later settling in New York, was appointed in 1683 one of the «commissioners» (judges) of the Court of the Admiralty. In 1689 he was the leader of the insurrection against Governor Nicholson, supported mostly by the militia and the lower classes; the fort and the public funds were seized on the 31st of May, and Leisler a few days later declared for William and Mary, asserting his acts to be necessary for the «preservation of the Protestant religion.» A committee of safety was formed, who on 8 June commissioned Leisler as «captain of the fort.» In this capacity he at once began to repair the fort, and strengthened it with a «battery» of six guns beyond its walls, which was the origin of the public park still known as the Battery. Nicholson and the council of the province, with the authorities of the city, attempted by pacific means to prevent the uprising, but without effect. Becoming finally alarmed for their own safety, the lieutenant-governor sailed for England, and the mayor with the other officials retired to Albany. On 16 August the committee of safety appointed Leisler «commander-in-chief of the province,» with the full power of a governor in all matters civil and military. He next attempted to reduce Albany and the northern parts of the colony, which from the first had refused to recognize his authority, but was for some time unsuccessful; Albany finally submitted to him after the Indian attack on Schenectady (1690). In December arrived a despatch from William and Mary directed «to Francis Nicholson, Esq., or in his absence to such as for the time being takes care for preserving the peace and administering the laws in his majesty's province of New York.» This Leisler construed as an appointment of himself as the king's lieutenant-governor. He therefore dissolved the committee of safetv, swore in a council, and assumed the style of a royal lieutenant-governor and commander-in-chief. After the massacre at Schenectady he engaged with great vigor in the expeditions against the French, and equipped and despatched against Quebec the first fleet of men-of-war ever sent from the port of New York. A few months later Major Ingoldsby arrived with the news of Sloughter's appointment as governor, and demanded possession of the fort, which Leisler refused. On Sloughter's own demand immediately upon his arrival in March 1691, he likewise refused to surrender it, until convinced of Sloughter's identity, and the latter had sworn in his council. Leisler was immediately imprisoned, charged with treason and murder, and shortly after tried and condemned to death. His son-in-law and secretary Milborne was also condemned on the same charges. These trials were manifestly unjust; the judges were the personal and political enemies of the prisoners, and Sloughter for some time hesitated to sign the death warrants. Leisler's son secured from the English Parliament the reversal of the bill of attainder in 1695; and the confiscated estates were also returned to the heirs. Consult Hoffman, 'The Administration of Jacob Leisler (in Jared Sparks, 'Library of American Biography,' Vol. XIII, Boston 1844); Brodhead, 'History of New York' (New York 1853–71); 'Documentary History of New York' (Albany 1842–51), and E. S. Brooks, 'In Leisler's Times' (a historical story).

LEIST, līst, **Burkard Wilhelm,** German jurist: b. Westen, Hanover, 12 July 1819; d. Jena, 31 Dec. 1901. He studied at Göttingen, Heidelberg and Berlin. He was appointed professor of civil law at Basel in 1846, at Rostock in 1847, and from 1853 he filled that chair at the University of Jena. He was a pupil of Savigny. His especial field of research was in the hypothetical field of Indo-Germanic law. Author of 'Die Bonorum Possessio' (1844–48); 'Mancipation und Eigentumstradition' (1865); 'Der Römische Erbrechtsbesitz' (1871); 'Altarisches Jus Gentium' (1889); 'Altarisches Jus Civile' (1892–96), etc.

LEITER, lī'tẽr, **Joseph,** American financier: b. Chicago, 4 Dec. 1868. He was graduated from Harvard in 1891, and was agent for his father, Levi Zeigler Leiter (q.v.), in 1892–98. In the autumn of 1897 he began buying wheat on the Chicago Board of Trade in an attempt to corner the market. Wheat prices soared to double their normal height and at the opening of the year 1898 Leiter held the largest private ownership of wheat in the history of grain trade. Concerted action on the part of his competitors broke the corner and Leiter is reputed to have suffered losses to the amount of $10,000,000. He is president of the Zeigler Coal Company, Chicago, and of the Chicago, Zeigler and Gulf Railway Company; and a director of the American Security and Trust Company.

LEITER, Levi Zeigler, American financier: b. Leitersburg, Md., 1834; d. 1904. He worked his way up in the retail drygoods from a clerkship in a country store to a partnership in the Chicago firm Coolidge, Wadsworth and Company. In 1865, together with Marshall Field, he sold his interest in that concern and they purchased a controlling interest in the drygoods establishment of Potter Palmer, the firm name then becoming Field, Palmer and Leiter. Upon Palmer's withdrawal it became Field, Leiter and Company until 1 Jan. 1881, when Leiter retired from the company and devoted himself to the management of his large real estate holdings and corporation interests.

One of his daughters was Mary Victoria, Lady Curzon of Kedleston.

LEITH, lēth, **Charles Kenneth**, American geologist: b. Trempealeau, Wis., 2 Jan. 1875. He was graduated from the University of Wisconsin in 1897. In 1900–05 he was assistant geologist in the United States Geological Survey. He was appointed assistant professor of geology at the University of Wisconsin in 1902, and since 1903 has been professor there. He has also served as professional lecturer in structural and metamorphic geology at the University of Chicago since 1905. He is author of a number of scientific papers and 'A Summer and Winter on Hudson Bay' (1912); 'Structural Geology' (1913); 'Metamorphic Geology' (1915).

LEITH, Scotland, a seaport and parliamentary burgh in the county of Midlothian, encircled on three sides by Edinburgh, on the south shore of the Firth of Forth, on the Water of Leith. It is connected with Edinburgh by Leith Walk — originally a line of earthworks built during the Cromwellian occupation, and by branch lines of the railways centering in Edinburgh. It is the principal seaport in the east of Scotland. Among the principal public buildings are the stately old parish church of Saint Mary's, custom-house, Trinity House, corn exchange, the new and well-equipped Leith Academy, including the Leith Technical College, and there are fine parks and public golf links. The chief manufactures are ropes, sail cloth, oil cake, paints, colors, artificial manures, and there are shipbuilding yards, iron foundries, engine works, flour mills, oil mills and refineries, steam saw mills, large maltings, an ice factory, etc. The foreign trade is chiefly with the Baltic and the principal French and German ports, and there is a trade in grain, flour, etc., with the United States and Canada. There are extensive wet docks and a fine roadstead, and several public graving docks, capable of receiving the largest vessels. It is the first of the fishery districts of Scotland. The quaint fishing village of Newhaven, on the west, is part of the burgh. The municipality is one of the most progressive in the kingdom; the water and gas undertakings are conjoined with Edinburgh, and it owns and operates its own electric plant and cable car systems.

Leith is a very ancient town its earliest charter dating from 1128.

It was besieged by the Lords of the Congregation during the Reformation period, and of the landing of Mary Queen of Scots on 1 Sept. 1561. Little of the old town remains, the narrow streets and alleys having been swept away by a great municipal improvement scheme. Leith, Portobello and Musselburgh, known as the Leith Burghs, return one member to the House of Commons. Pop. over 80,000. Consult Stevenson, 'Annals of Edinburgh and Leith' (1839); Irons, J. C., 'Leith and Its Antiquities' (1898).

LEITHA, lī'tä, Austria-Hungary, a river formed by the junction of two small streams near Neustadt, in Lower Austria, and flowing northeast on its course of 90 miles, a small part being along the frontier of Austria and Hungary, until it joins the Raab, a tributary of the Danube, at Altenburg. The Leitha Mountains rise between it and Lake Neusiedl, and it has a factitious importance in its application to Hungary as Trans-leithania and Austria as Cisleithania.

LEITMERITZ, līt'měr-ĭts, Austria, town and episcopal see of Bohemia, at the head of navigation on the right bank of the Elbe, 45 miles by rail northwest of Prague. It possesses a fine cathedral founded in 1057, and built in 1671, in which are some rare paintings. The episcopal palace was built in 1694–1701 and in its library are maps of Bohemia made by Nicolaus Claudianus of Jung-Bunzlau in 1518. The church of All Saints was built in the 13th century; and the town-hall, which is noted for its bell tower, was erected in the 15th century. Mention is made of the town as early as 993 and originally it was the site of the castle of a royal count. Its town charter dates from 1248 and it reached its greatest prosperity under Charles IV. It suffered severely in the Hussite wars and in the Thirty Years' War. The bishopric was founded in 1655. The town is situated in a rich agricultural region which is known as the «Bohemian Paradise.» Corn, fruit, hops, beer and wine are produced in abundance and the city has glass, leather, cement, chalk and brick industries. The river is spanned here by an iron bridge 1,700 feet long. Pop. 15,421.

LEITMOTIV, līt'mō-tēf, *in music*, the leading theme, the characteristic phrase, which occurs over and over again in the same composition, in reference to the same person, phrase of feeling or scenic complication of intense passion or action. The phrase strikes the note of these several crises or conjunctures and recurs whenever they are repeated. While many operatic composers, such as Mozart and Weber, have employed the expedient of the leading theme, Wagner does so more than any other modern musician. In his Leitfäden, or analyses of his operas, in which he lays bare some of the secrets of his artistic workmanship, he shows that he has consciously individualized every one of his characters, every change in the scenery or action of the drama, or in the emotions and moods of the *dramatis personæ*, by the introduction of a specific musical theme, which he employs throughout the opera to suggest the same thing. This theme is worked upon and varied with the masterly skill which Wagner possesses in fugue and part writing. Thus in his 'Parsifal,' Klingsor, Kundry, Parsifal, Amfortas and the Flower maidens are all ushered in with a special leading theme for each. There is a special theme for the Eucharist, for the spear (*Speermotiv*), for the Holy Grail (*Gralmotiv*). The children's voices raise a strain 'Faith is still alive' to the notes of the *Glaubensthema*, or faith-motive. There is a *Leidensmotiv*, to express the grief of Amfortas; there is the *Doormotiv*, expressing the promise of help; the *Zaubermotiv*, suggesting the devlish power of witchcraft, while the mother's sorrow is suggested by the Motiv des Herzleids, the heart-grief's theme. The Bell-theme, with its pealing sound, the Ride-theme, suggesting the clatter of horsehoofs, the Good Friday theme, with its characteristic chords, each in its way, are powerfully suggestive, and when once recognized, their recurrence has a powerful effect.

LEITNER, lĭt'nĕr, **Gottlieb Wilhelm,** Anglo-Hungarian Orientalist: b. Budapest, 14 Oct. 1840; d. Bonn, 22 March 1899. He was the son of a physician who went to Turkey in 1849, and, already well instructed in the classics, he quickly acquired Turkish, Arabic and modern Greek; he studied English, French and German at the British College at Malta. At the age of 15 he acted as interpreter in the Crimean War. He entered King's College, London, in 1858, was naturalized as a British subject and in 1861 received the appointment to the chair of Arabic and Mohammedan Law at King's College. In 1864 he went to Lahore as principal of the government college there and was instrumental in the establishment of various schools and libraries throughout India. He made extensive researches in the origins of Indian art and in Graeco-Buddist art, and also engaged in exploration of Tibet and other northern Himalayan countries. He edited the *Asiatic Quarterly Review* for some years, and is reputed to have acquired 25 languages. Author of 'The Languages and Races of Dardistan' (2 vols., 1867–71; 2d ed., 1877); 'History of Dardistan, Songs and Legends' (1881); 'History of Indigenous Education in the Punjab since Annexation' (1883). Consult Stocqueler, J. H., 'Life and Labours of Dr. Leitner' (1875).

LEITRIM, lē'trĭm, Ireland, county in the province of Connaught, bounded on the northwest by Donegal Bay, northeast by Fermaugh, east by Cavan, southeast by Longford, southwest by Roscommon and west by Sligo. The principal river is the Shannon and the scenery is beautiful; but the land for the greater share is poor, the tilled land amounting to one-third and pastureland two-thirds. Potatoes are grown, and oats, the only grain crop, give a small yield. Cattle, swine and poultry are raised; the county has minor coal mining interests, and there are manufactures of coarse linens and pottery. Leitrim was the ancient Hy Bruin-Brenny, forming the western part of Brenny, and was also called Brenny O'Rourke when in the possession of the descendants of Roderick, king of Ireland. It became County Leitrim in 1583. The population is 90 per cent Roman Catholic and depletion by emigration is more serious than in any other county in Ireland. Pop. 63,557.

LEIXNER-GRÜNBERG, lĭks'nĕr grün'bĕrg, **Otto von,** German poet and critic: b. Saar in Moravia, 24 April 1847; d. 1907. Among his poetical works are a volume of 'Poems' (1868); the drama 'Resurrection of Germany' (1870); 'Twilight' (1886); 'Proverbs and Satiric Rhymes.' He has also written short stories: 'The Two Marys'; 'Memento Vivere'; 'Princess Sunshine' (1882). Still other works are 'Marginal Notes by a Hermit'; 'Gossamer' (1886); 'Gossipy Letters to a Young Matron' (1890); 'Lay Sermons' (1894). His 'History of German Literature' (1879–82; 7th ed., 1906) is a notable work.

LEJEAN, lĕ-zhän', **Guillaume,** French explorer: b. Plouégat-Guérand, Finistère, 1828; d. there, 1 Feb. 1874. He specialized in the study of Breton history and of geography, and traveled in the Balkans in 1857–58 and 1867–70 in charge of an official mission for the study of geography. He made explorations in Egypt and Northern Africa in 1860–61; and in 1862 he was named French consul in Abyssinia, but with other Europeans was driven out in September 1863. He traveled in Kassala and the country of the Bogos in 1864, and in Asia Minor, Mesopotamia, along the Persian Gulf and the basin of the Indus in 1865. Author of 'La Bretagne, son histoire et ses historiens' (1850); 'Ethnographie der europäischen Türkei' (in Petermann's 'Mittelungen' 1861); 'Voyage aux deux Nils' (1865); 'Théodore II, le nouvel empire d'Abyssinie et les intérêts français' (1865). He also published maps of European Turkey and the Nile regions. Consult Cortambert, 'G. Lejean et ses voyages' (Paris 1872).

LELAND, Charles Godfrey, American author: b. Philadelphia, 15 Aug. 1824; d. Florence, Italy, 20 March 1903. He showed poetic talent in youthful contributions to newspapers and a growing genius, marked by unusual versatility, during his college days at Princeton, where he was graduated in 1846. He studied afterward at Heidelberg, Munich and Paris, giving special attention to modern languages, philosophy and æsthetics. In 1848 he took part in the revolutionary uprising in Paris; the same year returned to Philadelphia and studied law; was admitted to the bar in 1851, but gave up the legal profession and devoted himself to literary pursuits, becoming prominent in various fields of journalism and authorship. For a time he was editor of the New York *Illustrated News;* in 1861 established the *Continental Magazine* in Boston, and two years later returned to Philadelphia, where for several years he edited the *Press.* During the Civil War he published 'The Book of Copperheads,' a political satire. From 1869 to 1880 he resided chiefly in London. In England and on the Continent he studied gypsies and gypsy lore, in which he became one of the leading authorities of his time. His career as poet, ethnologist and traveler, with its mingling of literary avocations, was invested with an element of romance, and his more serious work was lightened by the interchange of humor. At the same time his achievements show the practical talents of a man of business. When in 1880 he once more returned to Philadelphia he was instrumental in establishing industrial teaching in the public schools, in furtherance of which he wrote a number of manuals and gave his supervision to the work. From 1886 he lived in Europe, mainly in Florence. He wrote and translated a large number of works, remarkable for variety as well as for literary value, the best known and most popular of which are 'Hans Breitmann's Ballads' (1867–70, 1895), written in "Pennsylvania Dutch," his translations from Heine, including 'Pictures of Travel' (1856) and 'Heine's Book of Songs' (1862), 'English Gypsies and Their Language' (1873), 'English Gypsy Songs' (in collaboration, 1875), 'The Gypsies' (1882) and 'Gypsy Sorcery and Fortune-Telling' (1892). Among his other writings are 'The Poetry and Mystery of Dreams' (1855); 'Meister Karl's Sketch-Book' (1855); 'Sunshine in Thought' (1862); 'Legends of Birds' (1864); 'The Music-Lesson of Confucius' (1870); 'The Egyptian Sketch-Book' (1873); 'Fu-Sang: or the Discovery of America by Chinese Buddhist

Priests in the Fifth Century' (1875); 'Johnnykin and the Goblins' (1876); 'Pidgin-English Singsong' (1876); 'Abraham Lincoln' (1879); 'The Minor Arts' (1880); 'Algonquin Legends of New England' (1884); 'Etruscan-Roman Remains in Popular Tradition' (1892); 'Autobiographical Memoirs' (1893); 'Songs of the Sea and Lays of the Land' (1895); 'Mending and Repairing' (1896); 'One Hundred Profitable Acts' (1897); 'The Unpublished Legends of Virgil' (1899); and (his last work) 'Kuloskap the Master, and Other Algonkin Poems' (1903), a volume of Indian folklore in verse, written in collaboration with John Dinely Prince. Consult Pennell, E. R., 'Charles Godfrey Leland: A Biography' (2 vols., New York 1906).

LELAND, or LEYLAND, John, English antiquary: b. London, about 1506; d. there, 18 April 1552. He was educated at Cambridge, Oxford and Paris. Returning home he took holy orders and Henry VIII made him his chaplain and librarian. In 1530 he became rector of Pepeling, near Calais; in 1542 he received the rectory of Haseley, Oxfordshire, and he was a prebend of Salisbury Cathedral. In 1533 he received the title of royal antiquary and was empowered by a commission under the great seal to search for objects of antiquity in the archives and libraries of all cathedrals, abbeys, priories, etc., in consequence of which he spent six years in traveling and collecting materials for the illustration of the history and archæology of England and Wales, but died without having completed his undertaking. The great bulk of his collections was placed in the Bodleian Library. The first part to be published was the 'Commentarii de Scriptoribus Britannicis,' issued in 1709 by Anthony Hall. In 1710 Hearne published the 'Itinerary' in nine volumes and five years later the 'Collectanea' was issued by him in six volumes. Leland wrote Latin poetry with considerable elegance, and a collection of his miscellaneous Latin verse and epigrams was published in 1589. Some of his autographic manuscripts are preserved in the Bodleian Library, Oxford, others in the British Museum. Consult Burton, 'Life of John Leland' (London 1896).

LELAND STANFORD JUNIOR UNIVERSITY, a coeducational institution at Palo Alto, California, about 30 miles southeast of San Francisco, in the Santa Clara Valley. The university campus comprises 9,000 acres of land, partly in the level of the valley and partly rising into the foothills of the Santa Moreno Mountains, which separate it from the Pacific Ocean, 33 miles beyond. The Bay of San Francisco lies in front at a distance of three miles and across it are the mountains of the Diabolo range.

The university was founded by Leland Stanford (q.v.) and his wife, Jane Lathrop Stanford (q.v.), as a memorial to their only son who died in his 15th year. The founders desired that the university should give a training primarily fitted to the needs of young men. Both sexes are admitted to equal advantages in the institution, but the number of young women who may attend at any given time is limited to 500. Beginning with the academic year 1916–17 the number of first-year men students will be limited to 500 annually. The object of the university, as stated by its founders, is "to qualify students for personal success and direct usefulness in life" and to "promote the public welfare by exercising an influence in behalf of humanity and civilization, teaching the blessings of liberty regulated by law, and inculcating love and reverence for the great principles of government as derived from the inalienable rights of man to life, liberty and the pursuit of happiness."

The endowment grant establishing the university was made in November 1885, under an act of legislature passed for this purpose; the cornerstone of the institution was laid in May 1887; and the university was formally opened to students on 1 Oct. 1891. The attendance for the first year numbered 559 and included all college classes with a number of graduate students, the university graduating its first class of 38 in May 1892. The original faculty numbered 35 professors and instructors, under the leadership of David Starr Jordan as president. In 1913 John Casper Branner became president, the office of chancellor being created for Dr. Jordan. On 1 Jan. 1916 Dr. Branner retired and was succeeded by Ray Lyman Wilbur, a graduate of the university.

The architecture of the university buildings is patterned after the old Spanish missions of California and Mexico. The buildings are of buff sandstone with red tile roofs. They form two quadrangles, one within another, with detached buildings grouped about them. The inner quadrangle consists of 12 one-story buildings, connected by an open arcade, facing a paved court of three and one-quarter acres in extent. Connected with this quadrangle at various points by corridors, and completely surrounding it, is the outer quadrangle of 12 buildings, for the most part two stories in height above the basement. This outer quadrangle is again surrounded by a continuous open arcade. In the inner quadrangle are the departments of law, of the different languages and mathematics, and the administrative offices. In the outer quadrangle are the scientific, engineering and geological departments, those of history, economics and English, and the library and assembly hall. In the rear of the quadrangles are the laboratories and shops of the engineering departments. The dormitories, one for young men and another for young women, with their gymnasia and athletic grounds about them, are located to the east and west. In front to the right of the main drive are the building of the department of chemistry and the art museum. A new and permanent library building, to replace one destroyed by the earthquake of 1906, will soon be begun.

Most striking among the architectural features of the university buildings were the Memorial Arch and the Memorial Church. The former was 100 feet in height, 90 feet in width and 34 feet deep, with an archway of 44 feet spanning the main entrance. This arch was destroyed by the earthquake and has not yet been restored. A sculptured frieze 12 feet in height, designed by Saint Gaudens, and representing the progress of civilization, surrounded it. The Memorial Church opens from the inner court and is opposite the main entrance. It is of Moorish-Romanesque architecture. The church, erected by Mrs. Stanford in memory of her husband, is adorned within and without with costly mosaics, representing, as do the beautiful stained windows, Biblical scenes and characters. It has a splendid organ of 46 stops and 3,000 pipes and a chime of sweet-toned bells. The church is non-sectarian in character and method. Religious services are held each Sunday morning and afternoon. There is a week-day vesper service and the organ is played each day at the close of recitations. The church was greatly damaged by the earthquake, but has been practically restored.

The students live in the dormitories, in club houses on the grounds or in private boarding-houses in the village, which is situated a mile distant from the university buildings. The professors live in homes provided on the grounds or in the village. Twenty Greek-letter societies for young men and 10 for young women occupy chapter homes on the campus.

In the government of the students, "the largest liberty consistent with good work and good order is allowed. They are expected to show both within and without the university such respect for order, morality, personal honor and the rights of others as is demanded of good citizens. Students failing in these respects or unable or unwilling to do serious work toward some definite aim are not welcomed and are quickly dismissed."

The university council consists of the president, professors and associate and assistant professors of the university faculty. To it is entrusted the determination of requirements for admission, graduation and other matters relating to the educational policies of the institution. It acts as an advisory body on questions submitted to it by the president or trustees. The routine work of the faculty is divided among various standing committees with power to act and responsible primarily, some to the council and some to the president. Departmental affairs are in the hands of subordinate councils consisting of the instructing body in the department, a member of which is designated by the president as presiding officer.

The general control of the university's affairs was by special provision in its charter reserved to the founders or either of them during their lifetime, they to act in the capacity of a board of trustees, the trustees themselves having only a nominal connection. This provision remained in force until July 1903, when under a special act of legislature passed for the purpose, Mrs. Stanford finally turned over to the board of trustees full authority and control over the university. The board of trustees numbers 15, members being elected for a term of 10 years. In educational matters the president of the university has the initiative, his acts being subject to the confirmation of the trustees. The board through a treasurer and business manager, one of their own number, administers directly the financial affairs of the institution.

The endowment of the university comprises 90,000 acres of land, including the Palo Alto, Vina and Gridley estates, and interest-bearing securities, the whole amounting to about $30,000,000, two-thirds of which is productive of income.

In its entrance requirements the university recognizes 29 entrance subjects of different values according to the time devoted to them in the secondary schools. The unit of value is a full year of high school work in the particular subject, and any 15 units, with certain limitations, chosen from this list constitute preparation for full entrance standing. The university has no list of accredited schools, but considers on its merits the work of all reputable schools. The student chooses a major subject, the professor in which becomes his adviser and to which he is required to devote one-fourth of his time. His remaining time is filled up by courses chosen by the student under the advice and direction of his major professor. Fifteen hours of recitations per week constitute the regular course throughout a period of four years. Students are graduated when they have completed 120 hours of work and the requirements of their major subject. Degrees are conferred in May, September and January.

The university grants the undergraduate degree of A.B. in all courses; the degrees of A.M. and Ph.D. for one and three years' work, respectively, beyond the undergraduate requirements; the J.D. and LL.B. degrees in law, M.D. in medicine, and that of Engineer for graduate work in engineering. The university grants no honorary degrees.

The work of the university is grouped under the following departmental heads:

Greek, Latin, Germanic languages, Romanic languages, English, philosophy, psychology, education, history, economics, law, mathematics. physics, chemistry, botany, physiology, zoology, entomology, anatomy, bacteriology, geology and mining, civil engineering, mechanical engineering, electrical engineering, medicine.

The university library contains 265,000 volumes. The attendance for the year 1915–16 was 2,197, of which 500 were women. The faculty numbers 214. Tuition is free, but all undergraduate students pay an incidental fee of $15 per semester, also the customary laboratory and class fees. A tuition of $100 a year in law and $150 in medicine are charged in the professional courses of these departments.

In recent years the most important development in the university has been the establishment and growth of the medical school in San Francisco, based on the Cooper Medical College foundation, which was taken over in 1908. The laboratories of anatomy, bacteriology, physiology, chemistry, etc., are located on the campus at Palo Alto. The professional courses are conducted in the city. The buildings of the school consist of a clinical and laboratory building, Lane Hospital, with a capacity of 180 beds, a nurses' home, and the Lane Medical Library building, containing 40,000 volumes. The university is about to erect a new hospital building at a cost of half a million dollars.

LELEGES, lĕl-ĕ'gēz', in ancient history a people supposed to have lived on the coasts of Greece, Asia Minor and the Ægean Islands. Homer mentions them as allies of the Trojans, but does not catalogue them in the 'Iliad,' nor is their dwelling-place given. Later writers confused them with the Carians. Pherecydes (5th century B.C.) describes them as inhabiting the coast of Caria from Ephesus to Phocæa, the Carians themselves occupying the land to the south; but Philippus of Theangela (4th century) refers to them as slaves of the Carians, as does Plutarch. The Hesiodic

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catalogue has a reference to the Leleges as a primitive tribe living in Locris in central Greece. After the 4th century B.C. various writers placed them west of the Ægean; and they are often confused with the Carians, later writers assuming that they were partners with them in raids upon the coasts of Greece. They were reported from the 4th century to have been discovered as having lived in various parts of Greece and certain writers believed them to be aboriginal. Place names connected with their tribes are scattered through Greece and Caria and seem to substantiate the theory of migration; although some authorities believe the Lelegian legends to have originated from the names of these places, such as Pedasus, Physcus, Larymna and Abae, rather than that they were founded by immigrant Leleges. The Greek accounts are considered better than the modern elaborations of them.

LELEWEL, lĕl'ĕv-ĕl, **Joachim**, Polish historian, geographer and numismatist: b. Warsaw, 22 March 1786; d. Paris, 29 May 1861. His family was of Prussian origin, but his father was naturalized as a Polish citizen. He was educated at Vilna, taught at Krzemieniec, Volkynia, and in 1814 became lecturer in history at Vilna. In 1818–21 he was lecturer and librarian at the University of Warsaw, returning then to his old position at Vilna. He was highly popular among the students and so gained the disfavor of the Russian governor, Novosiltsev, who in 1824 deprived him of his professorship. He removed to Warsaw, was elected to the Diet in 1829 and was connected with the revolutionary movement there, his activities making him so obnoxious to the government that he was forced to disguise himself to make his escape. He arrived in Paris in 1831, but was suspected by the Russian Ambassador of complicity in Polish plots and the French government, upon request, banished him in 1833. He then went to Brussels where he engaged in literary work, returning to Paris a few days before his death. His work evidences wide learning and careful research; and his maps, which he personally engraved in order to assure the preservation of their remarkable accuracy, are also of importance. Author of ‘Bibliograficznych Ksiag dwoge,’ A Couple of Books on Bibliography (2 vols., 1823–26); ‘La Numismatique du moyen âge’ (2 vols., 1835); ‘Etudes Numismatiques’ (1840); ‘La Géographie du moyen âge’ (with an atlas of 50 plates; 5 vols., 1852–57); ‘La Pologne au moyen âge’ (3 vols., 1846–51); ‘Polska,’ an historical survey of Polish affairs (20 vols., 1853–76), etc.

LELONG, le-lôṅ', **Jacques**, French bibliographer: b. Paris, 19 April 1665; d. there, 13 Aug. 1721. He was educated at Malta and at Paris, was ordained a priest in 1689 and became librarian at the Oratory of Saint Honoré, Paris, in 1689, remaining in seclusion there until his death. His work was not completed at his death; but was carried on by Fevret de Fontette who revised and extended the ‘Bibliotheque Historique’ (3 vols., 1768–72), and it was completed by Barbaud de la Bruyère (2 vols., 1775–78). Lelong was author of ‘Bibliotheca sacra,’ a catalogue of all the editions of the Bible (1709); and ‘Bibliothèque historique de la France,’ containing 17,487 items and many valuable notes (1719).

LELY, lĕ'lĭ, **Sir Peter**, Dutch painter: b. Soest, Westphalia, 1618; d. London, 30 Nov. 1680. His real name was Pieter van der Faes, but he assumed as his artistic title a nickname, Lely, or rather Le lys, which had been borne by his father. He was the pupil of Peter Grebber in his early manhood, but went to England in his 23d year and began his career as a portrait painter. His pictures were much admired and Charles I appointed him court painter. He painted the portrait of that sovereign and also of Cromwell, but he reached his greatest eminence after the Restoration. He was an imitator of Van Dyck, whom he almost equaled in the excellence of some of his earlier work. But as he fell in with the artificiality of Charles II's licentious court his manner lost much of its dignity and originality, and with a fatal facility he assumed that mannerism which detracts so much from the artistic worth of his portraits. His coloring as well as his drawing became weak and conventional. He was, however, a great favorite with the king and his famous ‘Beauties of Hampton Court’ was painted at the request of his royal master, these «beauties» being the loveliest women of the court, including the Duchess of Cleveland. His series of 12 ‘Admirals,’ painted for the Duke of York, is also well known. He is best represented at Hampton Court, National Portrait Gallery, London, at Greenwich and Windsor, and there are also two interesting portraits by him, one of Sir William Temple and one of Nell Gwynne at the Metropolitan Museum. Consult Baker, C. H. C., ‘Lely and the Stuart Painters’ (2 vols., London 1912). Lely founded the school of English portrait, and up to the time of Reynolds and Lawrence was its ablest representative. His method of handling, as well as his conception of the portrait, were long imitated, and even to-day have their influence.

LEMAIRE DE BELGES, lĕ-măr' dĕ bĕlzh, **Jean**, French poet and historiographer: b. Bavai, Hainault, 1473; d. about 1525. He was a nephew of Jean Molinet, of whom he called himself a disciple, but whose influences he outgrew. He studied at Paris and at Lyons, and about 1503 he became librarian to Margaret, Duchess of Savoy and subsequent regent of the Netherlands. He served the duchess on several missions to Rome, became canon of Valenciennes and afterward entered the service of Anne of Brittany. His work is largely free from the affectations of his immediate predecessors and is marked by a fine sense of rhythm. He had a marked influence over the succeeding poets of his country, Etienne Pasquier, Ronsard and Du Bellay being among his followers. Author of ‘Epitre de l'amand verd’; and ‘Illustrations des Gaules et Singularitez de Troye’ (1510–12). An edition of his work was prepared by J. Stecher (1882–85).

LEMAÎTRE, lĕ-mā'tr', **François Elie Jules**, French author, poet and critic: b. Vennecy, 27 April 1853; d. Paris, 6 Aug. 1914. On finishing his education he became a schoolmaster, but in 1884 decided to devote himself to literature. He became editor of the *Revue Bleue*, in which some of his articles attracted considerable attention. But his wide reputation is based almost entirely on his dramatic criticism. He was appointed dramatic critic on the *Journal des Débats* in 1886, and for many years he wrote weekly articles on the drama of a type that revolutionized the methods of criticism. His literary studies were collected under the title of 'Les Contemporaines' (1886–89), in which the studies of Flaubert, Zola, Victor Hugo and Ohnet created a great impression. His dramatic criticisms are collected in volumes entitled 'Impressions du Théâtre,' of which some 20 have been published. He also published two volumes of poetry and was the author of several plays. His first was 'Revoltée' (1889); 'Le Député Leveau' (1890); 'Marriage Blanc' (1891); 'L'Age Difficile'; 'La Massière'; 'Bertrade' and 'Le Pardon.' He was one of the supreme masters of lucid, witty and intellectual French.

LEMAN (lā-mäṅ) **LAKE,** a name sometimes given to the Lake of Geneva. See GENEVA, LAKE OF.

LEMARE, lĕ-mär, **Edwin Henry,** English organist and composer: b. Ventor, Isle of Wight, 1866. He studied at the Royal Academy of Music, was organist and director of music at Sheffield Parish Church in 1886–92, later filling those offices at Holy Trinity, Sloane street, and at Saint Margaret's, Westminster. He was organist in charge of the music at Carnegie Hall, Pittsburgh, in 1902–05; afterward twice gave recital tours in Australia and New Zealand; and was organist at the Panama Exposition in 1915. He has written numerous articles for musical periodicals on the subject of organ music and is author of more than 100 organ and choral works, and about 200 organ transcriptions from the great classical composers.

LEMAY, lĕ-mā', **Léon Pamphill,** Canadian poet and novelist: b. Lotbinière, province of Quebec, 5 Jan. 1837. He was educated at the University of Ottawa and became an advocate in 1865, but never engaged in practice. He was appointed librarian to the Quebec legislature in 1867, from which office he was retired on a pension in 1892. He was awarded an honorary Lit.D. at Laval University in 1888, where he also won two gold medals for poetry. He translated Longfellow's 'Evangeline' into French (1870). Author of 'Essais Poetiques' (1865); 'Le pèlerine de Sainte Anne' (1877); 'Picounoc le maudit'; 'Pöemes Couronnes' (1870); 'Les Vengeances' (1875; dramatized 1876); 'Petits Pöemes' (1883); 'Rouge et bleu' (1891); 'Les goutellettes' (1904).

LEMBCKE, lĕmb'kĕ, **Christian Ludvig Edvard,** Danish poet: b. Copenhagen, 15 June 1815; d. there, 20 March 1897. He was educated in theology, and in 1850 became rector of a Latin school at Haderslev. In 1864, after the Prussian invasion, he removed to Copenhagen, establishing a similar school there. He was well known as a translator from the English poets, his work including Shakespeare (18 vols., 1861–70; 3d ed., 1897–1900); Byron (2 vols., 1873–76); Thomas Moore's 'Lalla Rookh' (1878), etc. His original verse includes 'Digte og sang' (1870); 'Vort modersmaal er dejligt,' Our Mother Tongue (1859).

LEMBERG, lĕm'bĕrg, Austria, the capital of the crownland of Galicia, and the fourth city of Austria, on the Peltew, 470 miles by rail northeast of Vienna. Founded in the 13th century and formerly surrounded by walls, the city notwithstanding has a modern appearance, the walls having been replaced by boulevards and promenades. It is the seat of the crownland government, and of the important courts and public offices connected with it, also of three metropolitan sees, Greek, Armenian and Roman Catholic. The Greek church of Saint Nicholas dates from 1292, and the cathedral is a basilica (1740–79); the Armenian cathedral, in the Armenian-Byzantine style, dates from 1437; the Roman Catholic church of Saint Mary from 1363, and the cathedral is a Gothic structure of date 1480. The Dominican church contains a fine monument by Thorwaldsen. The university founded in 1784 and reorganized in 1817 is attended by over 5,000 students, and has a library of over 230,000 volumes. Since 1871 the language of instruction has been Polish; prior to that it was German. There is a botanical garden and a school of forestry. National Institute founded in 1817 by Ossolinsk has a library of over 180,000 volumes and 3,000 MSS. chiefly of Polish literature, and there is a museum of antiquities. The manufactures are extensive and varied, and there is a large trade, mostly in the hands of Jews. There is an electric street railway. The fair of the Three Kings is held here each January. The heterogeneous population consisting of Jews (57,587), Poles, Ruthenians and Germans numbered approximately 206,113. Over 85 per cent of the population speak the Polish language. Lemberg was from 1432–1772 the capital of the Polish province of Reussen. It was captured by the Turks in 1672, and by the Swedes in 1704, and fell to Austria in the first partition of Poland. At the outbreak of the European War in August 1914, a movement was made by the Russians to overrun eastern Galicia, and Lemberg was captured by them on 3 September; but was retaken by the Austro-German forces on 22 June of the following year. See WAR, EUROPEAN.

LEMBERG, University of, Austria, situated in the city of the same name, founded by Joseph II in 1784, and the third largest university in the country. It originated from a Jesuit school whose charter dated from 1661 but which did not receive papal sanction until 1758, 26 years before it was transformed into a state institution. It became a lycée in 1803, but was restored to its former status and reorganized in 1817, its marked growth dating from 1850. Until 1824 the language of instruction was Latin, German then succeeding it until 1871, since when Polish has been used. It has faculties of law, philosophy (including pharmacy), medicine and theology. There are more than 100 lecturers, about 5,000 students, and the annual budget amounts to about $275,000. The library contains about 230,000 volumes, 900 manuscripts and nearly 12,000 coins and medals.

LÉMERY, lām'rē,' **Nicolas,** French chemist: b. Rouen, 17 Nov. 1645; d. Paris, 19 June 1715. At an early age he displayed a taste for chemistry, went to Paris in 1666, and attached himself to Glaser. He soon left Glaser and took up his abode at Montpelier, where he had the free use of a laboratory, and began to give lectures which excited great interest and were attended by many of the influential inhabitants of the place. In 1672 he returned to Paris and gave courses of lectures on various parts of chemistry, the success of which seems to have been very great. His ‘Cours de Chimie’ appeared in 1675. This book went through numerous editions — 31, it has been calculated — and was translated into the chief European languages. The book is plainly modeled upon the prior treatises of Lefebvre and Glaser, the opening chapters being identical in manner and treatment, but shows proof of the author having profited by the work of his predecessors. In 1681 the religious troubles began to harass him; he was required to demit his office by a given time, and had ultimately, in 1683, to take shelter in England, where he was well received by Charles II, to whom he dedicated an edition of his book. He returned later to France, graduated as doctor of medicine at Caën, went to Paris, where he soon had a very large practice; but in 1685 the revocation of the Edict of Nantes forbade him, as a Protestant, the exercise of this profession. Against this he struggled for a little, but in 1686 joined the Roman Catholic Church. In 1699 he became an associate of the Academy of Sciences. Besides the ‘Cours de Chimie,’ Lémery wrote and published other works and papers, among which may be mentioned ‘Pharmacopée universelle’ (1697); ‘Traité universelle des Drogues simples’ (1698); ‘Traité l'Antimoine’ (1707). It deserves to be remembered that he was one of the first to attempt the elucidation of natural terrestrial phenomena by referring them to chemical action, and to exhibit these on an experimental scale, as when he made what is still known as Lémery's volcano, by placing a mixture of sulphur and iron in a hollow, heaping up the earth over the mixture, moistening and leaving it to itself. By-and-by combination between the iron and sulphur begins, heat is evolved, the earth heaves and swells, steam escapes, and the resemblance of the miniature eruption to the larger original is very striking. He left two sons, both of whom were afterward distinguished as chemists.

LEMIEUX, lĕ-myĕ', **Rodolphe**, Canadian lawyer and statesman: b. Montreal, 1 Nov. 1866. He was educated at Laval University and became a barrister in 1891. He was elected to the Canadian Parliament in 1896, serving successive terms, was Solicitor-General of Canada in 1904–06, Postmaster-General in 1906–11 and Minister of Marine in 1911. He served as special envoy to Japan in connection with the immigration trouble in 1907, and in 1910 he was Canadian delegate to the inauguration of the South African Union. He was appointed professor of the history of law at Laval University in 1907, and became a Fellow of the Canadian Royal Society in 1908. Author of ‘De la contrainte par corps’ (1896); ‘Les origines du droit Franco-Canadien’ (1900).

LEMIRE, lĕ-mĕr', **Jules Auguste**, French priest and social reformer: b. Vieux-Berquin, Nord, 23 April 1853. He studied at the College of Saint Francis of Assisi, Hazebrouck, and was professor of philosophy and rhetoric there from 1878–93. He was elected to the Chamber of Deputies in 1893 and was returned in 1898, 1902 and 1906. He organized the society *La Ligue du coin de terre et du foyer*, whose purpose was to secure a freehold for every French family wishing to own one. He was a conservative Republican and Christian Socialist in politics, and in 1893 vigorously opposed the closing of the Bourse du Travail, considering it an infringement of the rights of workers. He was appointed honorary canon of Aix in 1897, and of Bourges in 1900. In 1893 he was seriously injured in the Chamber of Deputies by the throwing of a bomb by the anarchist Vaillant. Author of ‘Le Cardinal Manning et son action sociale’ (1889); ‘D'Irelande en Australie’ (1892); ‘Que feront les religieuse?’ (1903).

LEMLY, Henry Rowan, American soldier: b. North Carolina, 12 Jan. 1851. He was graduated from West Point in 1872, and was appointed second lieutenant of the Third Cavalry. In March 1898 he was promoted captain, and during the Spanish-American War commanded Battery C of the Seventh United States Artillery in the Porto Rico campaign. He took part in Indian combats on Tongue River, Rosebud, Slim Buttes and Belle Fourche. He was retired at his own request 20 April 1899. For many years he was director of the National Military School at Bogotá, Colombia, and was commander-general for Colombia at World's Columbian Exposition 1893. He has published ‘What Was El Dorado?’; ‘Among the Arapahoes’; ‘West Point Romance’; ‘Padre Anselmo’; ‘A Queen's Thoughts’; also Spanish translation of Upton's ‘Infantry Regulations,’ and of an English translation of a French ‘Manual of Strategy’ (1887); ‘Ejercicios Gimnásticos’ (1889); ‘El Heliógrafo; Tactica de Infanteria’ (1901), etc.

LEMMENS, lĕm'ĕns, **Nicholas Jacques**, Belgian organist and composer: b. Zoerle-Parwys, province of Antwerp, 3 Jan. 1823; d. near Mechlin, 30 Jan. 1881. He studied at the Conservatoire at Brussels and in 1846 received a government pension for the purpose of studying at Breslau under Adolf Hessé. He was appointed professor of the organ at the Conservatoire, at Brussels in 1849, and for some years after 1857 resided much in England. He established a college for training Catholic organists and choirmasters at Mechlin in 1879. He married Miss Sherrington, a noted English soprano, in 1857. His work as a teacher is considered of exceptional importance in the improvement of methods which it influenced throughout the country. He composed more than 60 compositions for the organ, a Te Deum, two symphonies for orchestra and many pianoforte pieces. His ‘École d'orgue’ is used in the conservatoires of Paris, Brussels and other European cities.

LEMMING, a short-tailed, rat-like animal, related to the European voles and American meadow-mice, which inhabits the high mountains of Scandinavia. Its technical name is *Myodes lemmus*, and closely related species are found in northern Siberia and in Arctic America. In general appearance these animals are more like miniature short-eared, yellowish rabbits or pikas than like mice; they subsist wholly upon vegetable food, dwell in nests made of bark, grass, etc., in some sheltered nook, and do not hibernate but force their way about underneath the snow in search of moss, lichens, sprouting woody plants and other edible things. They are very prolific, rearing two broods of four to six young annually, and hence every few years they become so numerous that the mountains can no longer support the hordes. At such times, occurring at irregular intervals of several years according to circumstances, an exodus takes place and great numbers of lemmings descend from the mountains and spread over the lowlands. There the easier climate, more abundant food and absence of enemies, permit a still further multiplication, so that by the following season the little animals have increased into a plague. They wander more and more widely, overrun and damage, or sometimes wholly devour crops, gardens and meadows, and make themselves a destructive nuisance. Such an invasion is felt more severely in the narrow and fertile valleys of Norway than in the broader and more forested spaces of Sweden. At such a time concerted measures are devised to kill them off, carnivorous mammals and birds flock to the feast and epidemic diseases often break out among them. Spreading with a restless energy for travel, the lemmings overcome or attempt to overcome all obstacles and heedlessly plunge into lakes too large or rivers too swift to be crossed. When the remnants of the host reach the sea many of them boldly swim out in their ignorance of its magnitude and are drowned. Such overrunning of the country by lemmings is not known in Arctic Asia or America, where different conditions exist.

LEMMING-MICE, certain small, mice-like animals closely related to the lemmings and having similar traits, inhabit the region about Hudson Bay and the southern part of Greenland, of which the most prominent is *Cuniculus torquatus*, chiefly remarkable for its turning white in winter. Other species belong to the genera *Synaptomys, Lemmus*, etc.

LEMMON, John Gill, American botanist: b. Lima, Mich., 2 Jan. 1832. He studied at the University of Michigan, but left to enter the Federal army in June 1862, and was a prisoner at Andersonville, Ga., from August 1864 till the end of the Civil War. He has lived in California from 1866, where he was for four years botanist of the State Board of Forestry. He has published ‹Recollections of Rebel Prisons› (1874); ‹Ferns of the Pacific Slope› (1884); ‹Handbook of North American Cone Bearers› (1895); ‹Botanizing in Apache Land› (1901); ‹How to Tell the Trees› (1902), etc.

LEMNIAN EARTH, a reddish earth found in the island of Lemnos, celebrated as a remedy for snake-bites and various diseases, and collected by the ancients in accordance with special religious observances on only one day in the year. Analysis shows it to be composed of silica, 67 per cent; alumina, 14 per cent; water, 8 per cent; iron oxide, 5 or 6 per cent; soda, about 3 per cent and traces of lime and magnesia. Its classical name «terra sigillata» (sealed earth) is due to the fact that it was compressed and marked with the head of the Lemnian Diana. The earth is a fair substitute for soap, but has no medicinal properties.

LEMNISCATE, a curve formed by a point moving so that the product of its distance from two given points shall be the square of half the distance between the points. It is a particular case of the Cassinian oval. If the two fixed points be $(Ia, 0)$, the equation of the curve will be $(x^2+y^2)^2 = a^2(x^2-y^2)$, which becomes in polar co-ordinates $\rho^2 = a^2 \cos 2\theta$. The lemniscate can be produced by a section of a torus or anchor-ring the external radius of which is three times the internal radius by a plane tangent to the torus internally and parallel to its axis. It may also be generated as the locus of the foot of the perpendicular from the centre of an equilateral hyperbola to its tangent. The curve is shaped like a figure 8 and has the centre for a double point of inflection. The tangents at this point bisect the angles formed by the two perpendicular axes of symmetry of the figure. Curves formed from other curves after the manner by which the lemniscate is derived from the equilateral hyperbola sometimes receive the generic name of lemniscates. The one derived from the ellipse is especially interesting. The ordinary lemniscate was first discussed by Jacob Bernouilli in the *Acta Eruditorum* for 1694. The further development of the theory of the curve is due to Fagnano and Euler. Consult Brocard, ‹Notes de bibliographie des courbes géométriques› (Bar-le-Duc 1897).

LEMNIUS, lĕm'nĭ-ŭs, Simon (real name SIMON LEMM MARGADANT; sometimes called EMPORICUS or MERCATORIUS), German classical scholar and poet: b. Münsterthal, about 1510; d. Chur, 24 Nov. 1550. He is supposed to have studied at Munich and Ingoldstadt, and was under the direction of Melanchthon at Wittenberg. He early engaged in attacks upon the followers of Luther, written in Latin verse, and supporting Luther's enemies and the Elector Albrecht. The controversy grew so bitter that he was forced to leave Wittenberg. From 1540 until his death he was a teacher in the newly-established Mikolaischule at Chur. Author of ‹Epigrammaton Libri Duo› (1538); ‹Apologia contra decretum, quod imperio et tyrannide M. Lutheri et Justi Jonæ Vitebergensis Universitas evolgavit› (Cologne 1538); ‹Latii Pisæi Juvenalis Monachopornomachia,› in which he surpasses himself in bitter invective; ‹Bucolicorum Eclogæ Quinque› and ‹Amorum Libri Quatuor› (1542); ‹Homeri Odyssea Heroico Versu Facta, Accedit Batrachomyomachia› (1549); a Latin translation of Dionysius' ‹Periegesis› (1543), and a ‹Rhæteis› which remained in manuscript until 1874.

LEMNOS, the classical name for STALIMENE, the northernmost island of the Grecian Archipelago, between the Hellespont and Mount Athos. It anciently contained a volcano, Mosychlus, which was regarded as the workshop of Hephaistos (Vulcan), and was worshipped by the Greeks as sacred. The island belongs to Turkey and consists of two peninsulas almost separated by the harbors of Paradiso and San Antonio. It has an area of 160 square miles and abounds in vineyards, wheatfields, olive and fruit groves. The chief town is Limno or Kastro, with 3,000 inhabitants, a fortified place on the west coast. Pop., chiefly Greeks, about 27,000.

LEMOINE, lĕ-mwăn', Emile Michel Hyacinthe, French mathematician: b. Quimper, Finistère, 22 Nov. 1840; d. 1912. He studied at the École Polytechnique, and for some time was engaged in teaching. He was later for many years connected with the municipal gas department of Paris, and was distinguished for his ability in both mathematics and music. In geometry he was notable for his contributions to the development of the theory of the triangle. He was a founder of the Société Mathematique de France in 1871, and in 1894 he founded the scientific periodical *L'intermediaire des Mathématiciens.*

LEMON, Mark, English humorist and playwright: b. London, 30 Nov. 1809; d. Crawley, Sussex, 23 May 1870. He made his first essays in the lighter drama, and the modern London stage was supplied by his facile pen with more than 60 pieces, farces, melodramas and comedies, among which were ‘The School for Tigers,’ ‘The Serious Family’ and ‘The Ladies' Club.’ On the establishment of *Punch* in 1841 he became joint editor with Henry Mayhew, and two years later sole editor, controlling that periodical for 29 years. He was also literary editor of, and frequent contributor to, the *Illustrated London News.* Among his later productions are several novels: ‘Loved at Last,’ ‘Golden Fetters’ and others. He also edited ‘Mark Lemon's Jest Book.’ Consult Hatton, ‘Reminiscences of Lemon’ (London 1871).

LEMON, a small tree or spreading shrub (*Citrus limonia*) of the family *Rutaceæ.* It is a native of India, but has been introduced into tropical and subtropical countries throughout the world, especially those of the Mediterranean region, whence it was imported into Florida and California. In Florida the cold wave of 1894–95 destroyed most of the orchards, leaving only those in the southernmost counties, the soil of which is poorly adapted to the trees and must be carefully mulched, fertilized and managed to yield profitable returns. In California the lemon was introduced about 1850, but did not become commercially important until the closing quarter of the 19th century, during the last 10 years of which the annual shipments to Eastern markets averaged about 1,200 carloads, although half of the 400,000 trees had not yet reached bearing age. The climate is perfect, but the water supply is deficient, so that the orchards must be irrigated. The fruit is one of the most important grown in the United States, since, in addition to its value in food and drink, the citric acid of its juice is used upon a commercial scale by calico-printers, who by its aid remove iron from patterns stamped with certain dyes, and the oil or extract distilled from the rind is serviceable in perfumery, for flavoring, etc.

Owing to its spreading habit the tree must be carefully pruned, else it will make the necessary cultivation impossible, and will result in bearing fruit at or near the ends of long willowy branches. The trees are usually set about 20 feet apart each way, given clean cultivation and fertilization like the orange (q.v.). The fruit, which ripens during the winter, is cut, not pulled, green as soon as it is two and one-quarter inches in diameter, the picker carrying a gauge. These details have been found necessary since lemons ripened on the tree are of inferior quality and will not keep well, and since the market demands lemons in the summer. The fruit is spread in shallow trays and stored in a well-ventilated curing-house where by careful management it develops the characteristic yellow skin, which also becomes tougher, thinner, more pliable and silky and less liable to injury in handling. When properly managed, lemons are profitable, and because of the constant demand are more reliable than any other of the citrus fruits.

LEMON GRASS (*Andropogon nardus, a. schoenanthus* and *a. citratus*), any of several varieties of perennial tufted grasses native to southern Asia. It is of abundant growth, both wild and cultivated. It is of no value for grazing purposes except when very young, but it has a commercial value for the distillation of essential oils used in perfumery. The variety known as *andropogon schoenanthus* yields the lemon-grass oil of commerce, which is often passed as verbena oil. Other varieties yield citronella oil, also used in perfumery.

LEMON JUICE, the juice of lemons, a liquid usually opaque and turgid and exceedingly sour because of the presence of citric and malic acids. It is much used in the preparation of cooling drinks, usually combined with sugar and water, or with potassium bicarbonate. It is of value in the treatment of scurvy.

LEMON OIL, a volatile oil obtained, by pressure, from lemon peel. It consists chiefly of a terpene, $C_{10}H_{16}$, known as limonene, which boils at 349° F., and closely resembles citrene, though differing from it in certain essential particulars. Lemon oil has an agreeable odor, and is used chiefly as a flavor and perfume. It is reputed to change spontaneously into turpentine upon keeping, but this belief probably has no foundation in fact. Lemon oil mixes in all proportions with glacial acetic acid and with absolute alcohol.

LEMON VINE. See BARBADOS GOOSEBERRY.

LEMONNIER, lĕ-mōn'nyā', **Pierre Charles,** French astronomer: b. Paris, 23 Nov. 1715; d. Héril, near Bayeux, 31 May 1799. He was admitted to the Académie of Sciences when but 20 years of age, having prepared an elaborate lunar map; and in the same year was chosen to accompany Maupertis and Clairaut on a geodetic expedition to Lapland. He was largely instrumental in securing the introduction of English methods and instruments in French astronomical circles, and in 1741 introduced the use of the transit instrument at the Paris Observatory. He visited England and Scotland in 1748 for the purpose of observing the annular eclipse of 25 July. He made a careful observation of the disturbances of Jupiter and Saturn which later investigations confirmed; an important series of lunar observations covering a period of 50 years; investigations of terrestrial magnetism and atmospheric electricity, and succeeded in determining the places of a large number of stars. He was a lecturer at the Collége de France during a large portion of his career, was admitted to the Royal Society in 1739, and upon the founding of the Institute was one of the 144 original members. Author of ‘Histoire Céleste’ (1741); ‘Théorie des comètes,’ a translation with annotations of Halley's ‘Synopsis’ (1743); ‘Nouveau zodiaque’ (1755); ‘Observations de la lune, du soleil, et des étoiles fixes’ (1751–75); ‘Lois du magnétisme’ (1776–78), etc.

LEMPA, lĕm'pä, San Salvador, a river, the largest of Central America, which rises in Lake

Guija on the boundary of Guatemala and El Salvador, flows eastward through a broad and fertile valley for a distance of nearly 150 miles and then turning abruptly to the south breaks through the volcanic coast range of mountains and finishes its course of over 200 miles in the Pacific in lat. 13° 12′ N., long. 88° 41′ W., 35 miles southeast of the city of San Salvador. It has numerous large tributaries and is subject to sudden floods. The mouth of the river is obstructed by a bar, but the river is reached by a natural channel connected with the Jaltepeque estuary, and is navigable by small steamers for 100 miles.

LEMPRIÉRE, John, English classical scholar: b. Island of Jersey about 1765; d. London, 1 Feb. 1824. He was graduated at Oxford University in 1790, was ordained and began life as a schoolmaster. He afterward was appointed to the livings of Meeth (1811), and Newton-Petrock (1821). He is the author of the well-known classical dictionary (1788), which was founded on Sabatier's 'Dictionnaire des Auteurs Classiques.' He also published 'Sermons' (1791); 'Translation of Herodotus,' first volume only (1792), and 'Dictionary of Universal Biography' (1808); enlarged and reprinted by Lord (New York 1824).

LEMURES, lem'ū-rēz, among the ancient Romans, a term applied to departed spirits, especially those of ancestors who hovered about during the night. Probably the word was derived from the festival *Lemuria* held 9, 11 and 13 May, when at midnight the father of the family, with special ceremonies, nine times threw black beans over his head, thus banishing the spirits from the household for another year. Consult Fowler, W. W., 'Roman Festivals' (London 1899) and Wissowa, George, 'Religion und Kultur der Römer' (2d ed., Munich 1912).

LEMURIA, a name given by Haeckel to a vast area assumed to exist in past ages over the area of the present Africa, Indian Ocean and Malayan Archipelago, on the hypothesis that the existence of such a continent was necessary to explain the peculiar present distribution of the lemurs and other phenomena of geographical distribution. The discovery of the remains of lemurs in America and Europe rendered such hypothesis futile, and the idea was soon abandoned. Consult Wallace, A. R., 'Geographical Distribution of Animals' (London and New York 1876); Scott, 'The Lost Lemuria' (New York 1904); Steiner, R., 'Submerged Continents of Atlantis and Lemuria: Their History and Civilization' (Chicago 1911).

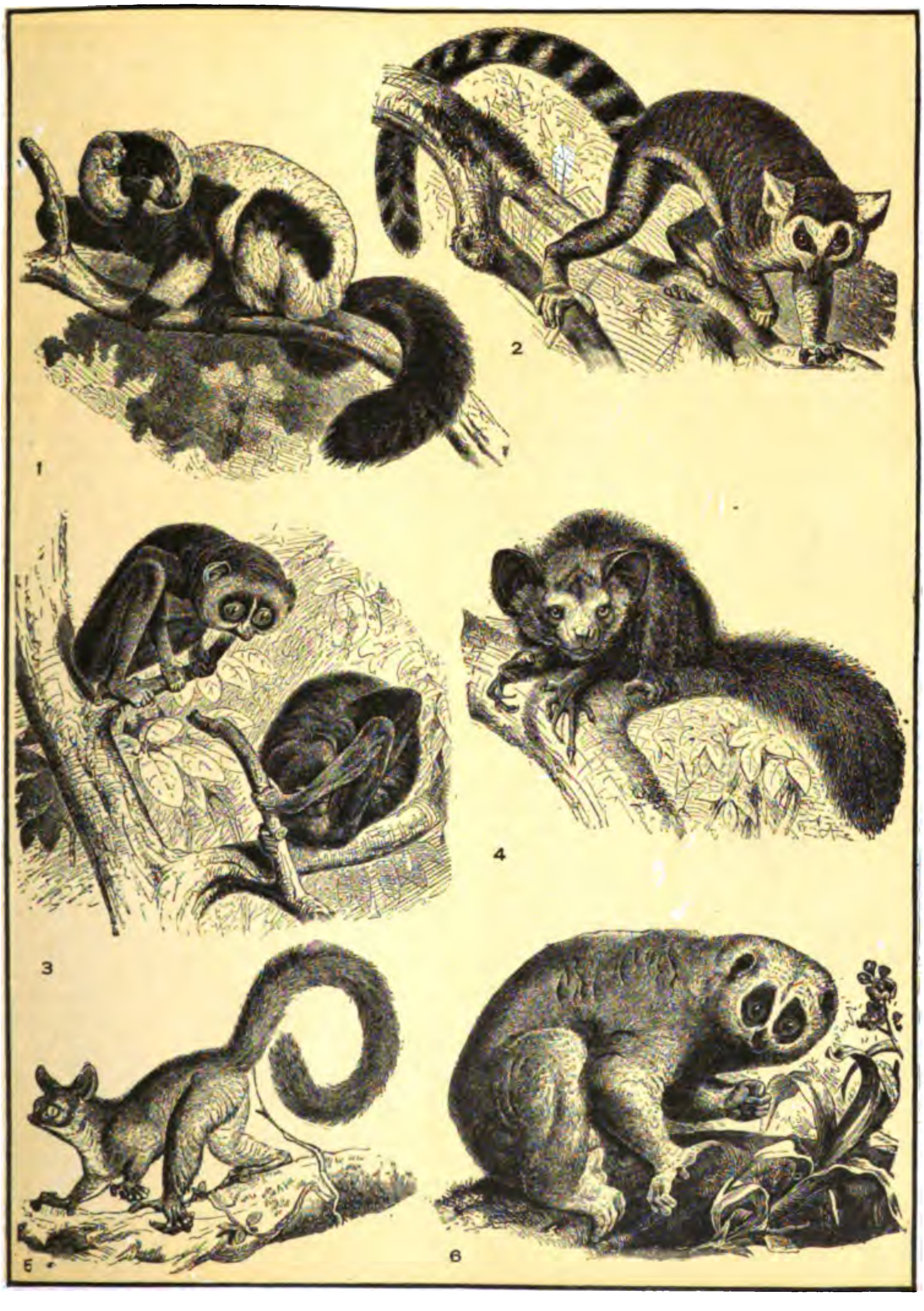
LEMURS, lē'mėrz, the curious monkey-like animals, or «half-apes» forming the group *Lemuroidea* within the order Primates, where they stand lowest in rank. They are divisible into three families, *Lemuridæ, Tarsiidæ* and *Chiromyidæ*. The last contains only the aye-aye (q.v.); and the second only the Malayan tarsiers (q.v.). The lemurs proper (*Lemuridæ*) are confined mainly to Madagascar, but a few are found upon the African continent, and a few others, of peculiar genera, in the Oriental region. They are chiefly arboreal, and more squirrel-like than monkey-like in their manners, and quite harmless, gentle and tamable. They are usally mouse-gray or yellowish, not marked in ornamental ways, the hair is long and often woolly, and the tail usually long, bushy and never prehensile. The hind-legs are longer than the fore-legs in the true lemures, which move about on all fours, not using their hands as do monkeys, although the thumbs are opposable; the second toe always has a sharp claw, while the other digits bear nails. In the internal anatomy many features are different from the rule of structure elsewhere in the order. The simplicity of the brain, the fact that certain arteries form retia mirabilia, and especially the non-deciduate condition of the placenta, are prominent among these lemuroid peculiarities. In general, however, the lemurs show much resemblance to the *Anthropoidea*.

The *Lemuridæ*, or lemurs proper, are divisible into four groups or sub-families. The first group (*Indrisinæ*) is limited to Madagascar, and includes several genera distinguished prominently by the great size of the hind-legs, as compared with the fore-limbs; and when upon the ground these lemurs walk erect, balancing themselves by holding their short arms above their heads. The largest is the indri (q.v.), which has no visible tail, while the smallest are the avahis (genus *Avahis*) which are the size of gray squirrels, but have very long tails. A third important genus is *Propithecus*, containing several large brightly colored species, called sifakas, which are mainly vegetarian, go about in large bands like the indris and seek food in the daytime, whereas the avahis are nocturnal; and are often tamed and taught to hunt like dogs.

The most typical Lemurs are in the sub-family *Lemurinæ*, which contains several genera, some of which inhabit the Comoro Islands as well as Madagascar. Their limbs are of nearly equal length, and they have a fuller dentition (36 teeth). Among the best known are the so-called «gentle» lemurs; the nocturnal grass-eating bokomboulis (*Haplemur*); and the handsome and highly arboreal species of the type-genus *Lemur*, which vary greatly in habits, food and appearance. One of these is familiar as the «Madagascar cat» or ring-tailed lemur (*L. catta*), since, unlike the rest, it remains upon the ground, especially about rocks, is easily caught and readily tamed. It is remarkable for the fact that the sexes differ in color, the male being black, while the female is reddish brown with white whiskers and ear-tufts, and the tail alternately ringed with brown and white. The ruffed lemur (*L. varius*) is still more strikingly diversified in black and white, and has a ruff of long hair about the neck. All these lemurs survive captivity well and furnish interesting specimens for all zoological gardens.

The third sub-family is that of the *Galaginæ*, represented in the continent of Africa and in Madagascar. The galagos (q.v.) have long hind-legs, causing them to hop like kangaroos, when on the ground (but the most of their life is passed in trees), large, semi-naked ears and long tails. Important genera are *Galago* (q.v.); the mouse-lemurs or chirogales (q.v.); and the diminutive, squirrel-like dwarf-lemurs (*Microcebus*).

LEMURS



1 Ruffed Lemur
2 Ring-tailed Lemur
3 Slender Loris
4 Ayeaye
5 Great Galago
6 Common Loris

The sub-family *Lorisinæ* contains a group of small lemurs, distributed widely in Africa, India and Malaysia. «In external appearance,» remarks Beddard, «all the three genera of this sub-family agree in their small size, their short or entirely deficient tail, large staring eyes, and the rudimentary character, or absence, of the index finger, which is never provided with a nail; in all of them the thumb diverges widely from the other fingers, and the great toe is so divergent as to be directed backward.» The ears are small and rounded; and the eyes are very large, and situated close together on the front of the head. They feed on small birds and insects, and are chiefly nocturnal in habits. They inhabit India, Ceylon and the Eastern Archipelago. The genus *Nycticebus* contains the remarkable «sloth monkey» or sloth lemur (*N. tardigradus*), which is nocturnal, howls dismally at times and is the object of many fears and superstitions among the Malays and southern Chinese. The genus *Perodictus* contains the queer African pottos and angwantibos. The most typical species of the group is the slender loris (*Loris gracilis*), a pretty little arboreal animal of the Malayan countries. It is described as «smaller than a squirrel, of exceeding changeness and grace, with beautiful eyes.»

The geographical and geological distribution of the lemurs is very interesting. Their remains are found in the rocks as far back as the transition period (Puerco beds) between the Cretaceous and Tertiary, the oldest occurring in the western United States. These are small lemuroids, and similar forms are found in the early Tertiary rocks of Europe, Asia and Africa. Many genera are known. The most recent, which may have survived in Madagascar until the discovery of that island by Europeans, was *Megaladapis*, which must have been three or four times bigger than any modern species. The circumstance that existing lemurs and certain other animals occurs only in south-central Africa, Madagascar and the Oriental region, and nowhere between, was so extraordinary a fact in zoogeography that early attempts to account for it resulted in the hypothesis of an ancient continental land-area, called *Lemuria* (q.v.) which was supposed to connect Africa and southern Asia. This theory had little other foundation, and the subsequent discovery of remains of extinct lemurs in Europe, western Asia and the two Americas showed that it was needless. It is evident that the existing lemurs are the survivors of a once world-wide race which has died out except in certain islands and favorable corners of the world where they are not exposed to cold climates nor to too many enemies. The almost complete absence of predatory animals in Madagascar doubtless explains the comparatively great number of lemurs characteristic of that isolated country.

Consult Beddard, 'Mammalia' (1902); Forbes, 'Allen's Naturalists' Library' (1894); Lydekker, 'Royal Natural History,' Vol. I, (1893); Mivart and Murie, 'Anatomy of the Lemuroidea,' (in Trans.-Zool. Soc. of London, Vol. VII 1872); Ingersoll, 'Life of Mammals' (New York 1909).

LENA, lā-nā' or lē'nạ, Siberia, one of the largest rivers in the world, draining about 1,000,000 square miles, rising on the northwestern side of the mountains which skirt the western shore of Lake Baikal, about 180 miles east-northeast of Irkutsk. It flows in a winding but mainly semi-circular course, north-northeast and northwest, receiving the Vitim, the Aldan, the Viliui and other tributaries. Then a mighty stream it flows generally north. About 800 miles from the ocean it is over five miles in width. Near its mouth it separates into branches, forms a great number of deltaic islands and discharges itself into the Arctic Ocean by several mouths in lat. 73° N. and long. about 128° E., having thus passed over 21 degrees of latitude and 22 degrees of longitude. Its direct course, through a generally barren country interspersed with a few dense forests, but in some parts with valuable minerals, is about 1,480 miles; its actual course, windings included, about 2,850 miles. It is navigable through the greater part of its upper course, is rich in fish, is frozen from October to May and disastrous floods are often caused by the melting of ice in its upper parts.

LENÂPÉ (lĕn'ạ-pā) **STONE**, in archæology, a name given by H. C. Mercer to an inscribed gorget found in Bucks County, Pa., in 1872, upon which was incised a spirited combat between men and a mastodon; lightning intervening and aiding the men in the destruction of the beast. The stone told pictorially the legend recorded by Jefferson in his 'Notes on Virginia.' Since its discovery the stone has been condemned by most archæologists, and not always on the same grounds, and it is probable that it will not be accepted generally as genuine until abundant corroborative evidence has been obtained. If genuine, the stone establishes two interesting facts concerning the Indians of the Atlantic seaboard; that the mastodon or mammoth was living when these people were at the climax of their cultural development, or, if not a feature of practically our present fauna, then that the advanced Indian lived at a much more remote period than is generally supposed. The evidence now had concerning the mastodon is that it was living about 2,500 years ago, and this antedates the Indian as so advanced an occupant of this region. That man has been an occupant of our seaboard region since the Glacial Epoch is demonstrable and his contemporaneity with so recently extinct an animal as the mastodon is certain. The principal objection that can be brought against its genuineness is that it is so far in advance of all other known specimens of Indian pictographic art. Consult Mercer, H. C., 'The Lenape Stone' (Philadelphia 1885).

LENARD, le-närt', **Philipp**, Hungarian physicist: b. Pressburg, 7 June 1862. He studied at the universities of Budapest, Vienna, Berlin and Heidelberg. He became privatdocent at Bonn in 1891, taught at Breslau in 1894, at Aachen in 1895, was appointed professor at Heidelberg in 1896 and at Kiel in 1898, returning to Heidelberg in 1907. In 1909 he was appointed head of the new radiological institute at Heidelberg. He received the Nobel prize for physics in 1905. Author of 'Ueben Kathodenstrahlen' (1906); 'Ueber Aether und Materie' (1910).

LENAU, lā-nou, **Nikolaus** (pseudonym for Nikolaus Franz Edler von Niembsch von Strehlenau), Austrian poet: b. Csatád, near Temesvár, Hungary, 13 Aug. 1802; d. in the insane asylum at Oberdöbling, Austria, 22 Aug. 1850. His father, Franz, was an official of the Hungarian Treasury (d. 1807); his mother, who later (1811) married the Budapest physician Karl Vogel, d. 1829. Lenau is perhaps the most melancholy and pessimistic poet in German literature; in fact he is frequently set up as a type of the denial of life, as opposed to Nietzsche, who is taken as an affirmation of life. His early education was irregular and evidently guided by the tendency to encyclopedic knowledge which is rather common among Germans and which makes German writers frequently feel their kinship with Faust. He attended the Piaristengymnasium at Budapest (1812–15), studied philosophy at the University of Vienna (1819–20), then at Pressburg (1821); he then turned to law, at Vienna (1822–26), interpolating one semester of agriculture, at the Hungarian University of Altenburg; he later even pursued medical courses at Vienna. In the autumn of 1831 he was attacked, at Heidelberg, by profound melancholy, from which he felt there would be no deliverance except through a trip to America, which he undertook in 1832; his experiences, owing to his sensitive and over-delicate nature, must have been very unpleasant, for he returned to Europe in 1833, settling down in many places in Bavaria and Austria. Ferdinand Kürnberger's novel, 'Der Amerikamüde,' is a free rendering of Lenau's American disillusionment, and a number of poems by Freiligrath, Heine and Herwegh were suggested by the same situation. Lenau became insane in October 1844 and spent the rest of his life in confinement. He is, as a lyricist, close to Goethe in importance, full of color and temperament; Austria's greatest poet, presenting a powerful infusion of Slavic melancholy, together with ingratiating voluptuousness and passionate fire. Many of his poems and ballads have become popular. His epic attempts are rather lyric and fragmentary in quality; 'Faust' (1836); 'Savonarola' (1838); 'Die Albigenser' (1843); 'Don Juan' (posthumous).

Jacob Wittmer Hartmann.

LENBACH, Franz von, frānts fōn lĕn'bäh, German painter: b. Schrobenhausen, Upper Bavaria, 13 Dec. 1836; d. Munich, 6 May 1904. His father was a stone mason and in boyhood he followed his father's trade. As a youth he painted portraits at a gulder (40 cents) each. At the suggestion of Hofner, the animal painter, he turned to the study of art and became a pupil of Geyer in Augsburg. He subsequently attended the Munich Academy for a short time and then for two years studied the technique of painting under Gräfle. From 1855 to 1857 he lived as one of the artistic coterie of Schrobenhausen and painted portraits, landscapes and animals. He then attached himself to Piloty and as the pupil of that artist accompanied him to Rome. Here he applied himself to the study of the old masters and painted his picture 'The Roman Forum,' whose vivid coloring and grandeur of design made his reputation. After his return to Germany he painted several portraits, which were distinguished by a power of coloring rivaling that of the Venetian school, and a vivid characterization and chiaroscuro which recalled Rembrandt. He was for a few years teacher in the Weimar school of art, but eventually returned to Munich and attracted the attention of Baron von Schack, who engaged him to visit Italy and Spain for the purpose of making copies of the principal paintings of Giorgione, Velasquez, Titian, Rubens and others. The copies executed by the painter have all the individual tone and color of each original and he developed immensely his own power and style by their production. This appears most plainly from an examination of his portraits which, original and fresh as they are, show plainly that the master had trained himself in the school of Titian, Rembrandt and Velasquez. Though his drawing is sometimes weak and incorrect, his paintings nevertheless are characterized by powerful modeling, life-like expression, and as a portrait painter while he disregarded contour, his remarkable sense of character enabled him to see to the soul of his sitter with genial and sympathetic intuition. It is from his series of portraits of the makers of modern Germany that these men will be known to posterity — the force and vividness of which reflect their personalities. He painted the Emperor William I in the last year of that monarch's life; he executed several portraits of Von Moltke and 100 portraits or sketches of Bismarck, their features becoming familiar to the world largely from the numerous reproductions of these inimitable pictures, now looked upon as classic examples of German art. Bismarck especially appears in these canvases in every attitude and costume, civil and military, which he assumed. Many of these portraits are in the picture galleries of Berlin. He painted in his time every living man of eminence in Europe from Gladstone to Leo XIII. He was less successful with feminine types. He also executed many pastel portraits as well as single ideal figures ('Sakuntala,' 'Herodias,' etc.). He was a Royal Bavarian professor. Honors were rained upon him. He was ennobled by the Prince Regent of Bavaria. He married a grand-niece of Von Moltke. A collection of heliogravure reproductions of his paintings was published at Munich in 1891.

LENCAN, or **LENCAS**, a group of native tribes in southern Honduras and northern Nicaragua, possessing a language distinct from that of neighboring tribes, but divided into several dialects. They are semi-civilized and of peaceful habits, although they fight on occasion. There is but scanty history concerning them available and their relation to the whites is largely unknown. They are among the tribes at one time designated as "Chontal," a name covering several undistinguished groups in Central America, but which for the greater share are now known and named individually.

LENCLOS, lŏñ-klō, **Anne**, French courtesan, better known as Ninon de Lenclos: b. Paris, 15 May 1615; d. there, 17 Oct. 1705. She was famed for her beauty and notwithstanding her reputation some of the most respectful ladies of the time cultivated her friendship, and in her old age her house was the rendezvous of the most distinguished personages of the city and court. Scarron consulted her on his romances, St. Evremond on his poems, Molière on his comedies, Fontenelle on his dialogues and La Rochefoucauld on his maxims. Richelieu is said to have been her first lover, and Coligny, Condé, Sévigné, etc., were her lovers and friends. She retained the charms of her manners and conversation, and to some extent of her person, to extreme old age. She is the prototype of Mademoiselle de Scudéry's 'Clelie' (Paris 1556-60).

LEND A HAND CLUBS, organizations of young persons established in the United States in 1871, for religious, philanthropical and social purposes. The name is derived from a story by Edward Everett Hale, entitled 'Ten Times One is Ten,' published in 1870. Each club creates its own constitution, but follows a common motto:

"Look up and not down,
Look forward and not back,
Look out and not in,
Lend a hand."

The badge of the club is a Maltese cross, with the inscription «In His Name.» A central federation called the Look Up Legion was formed at Chautauqua, N. Y., in 1874, and the *Lend a Hand* was founded, a journal of the societies.

LENEPVEU, lā-nā-vė, **Charles Ferdinand,** French composer: b. Rouen, 1840. A pupil of Savard, Ambroise Thomas and Chauvet, he obtained the Prix de Rome in 1865, and was appointed professor of harmony at the Conservatory in 1881 and of composition in 1894. He became a chevalier of the Legion of Honor in 1887 and a member of the Institute in 1897. His works, which are lacking somewhat in inspiration, include the sacred drama 'Jeanne d'Arc,' first given in the cathedral of Rouen in 1886, several operas, a requiem Mass, 'Méditation' for orchestra, and various choral and solo compositions.

LENEPVEU, Jules Eugène, zhül ė-zhän, French painter: b. Angers, 1819; d. 1898. He was a pupil of Picot and at the Beaux-Arts, won the Prix de Rome in 1847, painted several canvases ('Les Martyrs aux Catacombes'; 'Pius IX in the Sistine Chapel'; 'Venetian Night'; 'Hylas,' and others), and executed many frescoes in public buildings at Paris, Angers and elsewhere.

L'ENFANT, lŏṅ-fäṅ, **Pierre Charles,** French-American engineer: b. France, 1755; d. Prince George's County, Md., 4 June 1825. A lieutenant in the provisional service of France, in whose best military institutions he had been trained, he came to America with Lafayette in April 1777; built Fort Mifflin (on the Delaware), which successfully resisted one of the most vigorous attacks of the Revolutionary War, and by his skill as a designer of fortifications attracted the attention of Washington, who made him chief of engineers, with brevet of major of engineers. He remodeled and refitted the City Hall in New York for the use of the first Congress, and later also the Federal House in Philadelphia. Washington and Jefferson selected him to draw the plan for the «new federal town,» and during the spring and summer of 1791 he was employed in the elaboration of his plans. Jefferson wished the design to be that of a chess-board regularity of squares, but L'Enfant broke the monotony of this arrangement by inserting numerous avenues running at acute angles. His plan was approved by Washington, and he was retained to direct the execution of it. The commissioners in general charge of the work advertised a sale of lots for October 1791 and requested L'Enfant to furnish his plan to be engraved and published. This he refused to do, asserting that speculators would purchase the best locations in the «vistas and architectural squares» and «permanently disfigure the city» by «huddles of shanties.» For this insubordination Washington ordered his dismissal, 1 March 1792. For planning the «federal city» and devoting his time for months to the survey and other preliminary operations L'Enfant received only $2,500 and a lot near the executive mansion, a compensation quite in accord with the general economy with which the work was prosecuted. He requested the commissioners to recall the order for the money and «not take any further trouble about the lot.» Later, Madison appointed him professor of engineering at West Point, but he declined the post. He designed several public works at Philadelphia and was appointed to construct the present Fort Washington (on the Potomac). He partly executed the work, but disagreed with his superiors and was dismissed. He lived latterly at Chellum Castle, the residence of Dudley Digges, near Bladensburg, Md., and frequented the halls of Congress seeking in vain for a reward for past services. The execution of his plan for Washington was continued by his assistant, Andrew Ellicott, later professor of mathematics at West Point. L'Enfant's design may be viewed in the Library of Congress. To L'Enfant is chiefly due the fact that to-day Washington is one of the most picturesque cities of the world. See WASHINGTON.

LENHER, lĕn'ĕr, **Victor,** American chemist: b. Belmond, Iowa, 13 July 1873. He was educated at Dickinson College and at the University of Pennsylvania and engaged in teaching. He was assistant professor of chemistry at the University of Wisconsin in 1900-04, and associate professor there in 1904-07, since when he has been professor. Author of numerous papers on research in organic chemistry published in scientific journals; a translation of Moissan's 'Electric Furnace' (1904), and 'Laboratory Experiments' (1902; 4th ed., 1906).

LENINE, Nikolai (also known under his real name NIKOLAI ILYITCH ULYANOV, and under another pseudonym, VLADIMIR ILYIN), Russian socialist: b. 1870, of a noble origin. Like a brother, who was hanged when Lenine was 17 years old, for plotting to kill the Tsar, Lenine began his revolutionary activity when he was still quite young. Most of Lenine's life has been spent in exile, chiefly in Switzerland, where many of his economic and political writings were produced. This exile was imposed upon him by the necessity of avoiding imprisonment in Russia for the propagation of anti-Tsarist and Socialistic views. Even before the opening of the European War in 1914, Lenine had long been occupied with the problems of the international Socialist movement; his works (printed in the Russian language in various parts of Europe) dealt with the problems of imperialism and opportunism and revealed a profound understanding of the function of finance and industry in forcing imperialistic wars, as well as a hatred of the political leaders who supported wars of this type. Among his works published in Russian were ‘What Next? Burning Questions of Our Movement’ (Stuttgart 1902); ‘Two Tactics of the Social-Democratic Party in the Democratic Revolution’ (Geneva 1905); ‘On Rural Poverty’ (Geneva 1905); ‘The Dispersal of the Duma and the Tasks of the Proletariat’ (Moscow 1906); ‘Martov and Cherevanin in the Bourgeois Press’ (Saint Petersburg 1906), and a Russian translation of Karl Marx's ‘Civil War in France’ with Engels' Preface (Odessa 1905). His hatred of opportunism expressed itself in a pamphlet attacking Karl Kautsky (Saint Petersburg 1906), as well as in numerous subsequent attacks on that leader of the Centre faction of the German Social-Democratic party. Such also is the content of the periodicals edited by Lenine in Switzerland (*Kommunist,* 1915; *Sbornik,* 1916). After the outbreak of the Revolution in Russia, March 1917, while Leon Trotzky (q.v.) was attempting to reach home from New York, Lenine succeeded in passing into Russia through Germany. Immediately on his arrival in Petrograd he began to oppose the opportunist and coalition policy of the Menshevik faction of the Social-Democratic party in Russia (Lenine himself was a member of the Bolshevist, or «Maximalist» faction, after the split that had occurred at the party convention in 1903), which was aided by the right wing of the Social-Revolutionaries. Kerensky, who had joined the latter party after the success of the March Revolution, was for a continuation of the war with Germany, which was opposed by the tortured and wearied Russian population. After the July (1917) offensive, which threw thousands of ill-equipped troops into the slaughter, Kerensky and the Menshevik faction became unpopular, and this unpopularity grew until the Bolsheviki, under the guidance of Lenine and Trotzky, overthrew the Kerensky government and established a «dictatorship of the proletariat» (6 Nov. 1917, N.S.). Lenine, in a session of the Workers' and Soldiers' Council (*Soviet*), introduced his famous proposals on land and peace, which were both passed with a great majority on 7 November. Within a few days came the publication of the «Secret treaties» (reprinted January 1918 by the *New York Post*), the apportionment of land to the peasants and the opening of preliminary peace discussions with the German delegates at Brest-Litovsk. Lenine himself in numerous articles defended the signing of a separate peace with Germany (consult the *Class Struggle,* New York 1918, and *The Revolutionary Age,* Boston 1918). In February 1918 the German troops advanced further into Russia, contrary to the stipulations of the treaty, and imposed still more humiliating conditions upon that country. Consult Nuorteva, Santeri, ‘An Open Letter to American Liberals’ (New York 1918); Reed, John, ‘The Sisson Documents’ (New York 1918), also numerous articles in *The Liberator,* New York 1918–19. Consult also, in English, Lenine's ‘Political Parties in Russia’ (New York 1917); ‘The Soviets at Work’ (New York 1918); ‘A Letter to American Workingmen’ (New York 1918); ‘The State and the Revolution’ (New York 1919); ‘The Lessons of the Revolution’ (New York 1919).

LENNEP, lĕn'nĕp, **Jacob van,** Dutch dramatist, novelist and poet: b. Amsterdam, 24 March 1802; d. Oosterbeek, near Arnheim, 25 Aug. 1868. He took his degree in law at Leyden and became a successful advocate at Amsterdam. His first published work consisted of translations from Byron, and his first volume of original verse appeared in 1826. He began the publication of novels in 1828 and steadily gained in popularity, his position in Dutch literature being similar to that of Sir Walter Scott in English. He was further distinguished for the production of several widely popular patriotic songs and plays at the time of the Belgian revolt. He wrote a Dutch history for juveniles in a pleasing style and was a versatile journalist and critic. He served in a judicial capacity for several years and was a member of the Second Chamber in 1853–56. Several of his novels have been translated into French, German and English. Author of: Verse, ‘Academische Legenden’ (1826); ‘Nederlandsche Legenden’ (2 vols., 1828); the patriotic comedies, ‘Het Dorp aan de Grenzen’ (1830), and ‘Het Dorp over de Grenzen’ (1831); the historical romances, ‘De Pleegzoon’ (1833); ‘De Roos van Dekama’ (2 vols., 1836); ‘Onze Voorouders’ (5 vols., 1838); ‘De Lotgevallen van Ferdinand Huyck’ (2 vols., 1840); ‘Elisabeth Musch’ (3 vols., 1850); ‘De Lotgevallen van Klaasje Zevenster’ (5 vols., 1865); the juvenile history ‘Geschiedenissen van Noord-Nederland aan mijne Kindern verhaald’ (4 vols., 1845). He was also author of several dramas.

LENNGREN, lĕn'grăn, **Anna Maria** (MRS.), Swedish poet: b. probably at Upsala, 18 June 1755; d. Stockholm, 8 March 1871. She was the daughter of Magnus Malmstedt, a professor at the University of Upsala, and received an excellent education. Her verse was successful from its first publication, when she was 18, and she also engaged in making translations of French and Latin plays for production at the court. She continued writing after her marriage to Karl Peter Lenngren, an editor of the *Stockholmpostem,* in 1780, and her verse appeared anonymously in that publication for some years. She wrote in a facile, natural style with a simplicity and truthfulness that made her widely popular among her countrymen. Her works were published in collected form, ‘Skaldeförsök’ (1819; with a ‘Life’ by Carlén, 1856; with a ‘Life’ by Warburg, 14th ed., 1907).

LENNI LENAPE, lĕn'ĭ lĕn'ạ-pe, an important Algonquin tribe. See DELAWARE INDIANS.

LENNO LENAPES, lĕn'nō lĕn'ạ-pēz, the native name for the Delaware Indians (q.v.).

LENNON, John Brown, American union labor leader: b. Lafayette County, Wis., 12 Oct. 1849. He received a public school education and in 1886–1910 he was general secretary of the Journeymen Tailors' Union of America, editing in those years *The Tailor.* From 1889 he was treasurer of the American Federation of Labor. He is a member of the Commission on Industrial Relations appointed by President Taft in 1912 and reappointed by President Wilson; is vice-president of the Illinois Anti-Saloon League, and has lectured on social problems.

LENNOX, Charlotte Ramsay, Anglo-American miscellaneous writer: b. New York, 1720; d. London, England, 4 Jan. 1804. She was the daughter of the lieutenant-governor of New York and was educated in England. She married and being left a widow in narrow circumstances took up literature for support. Her best work is ‘Shakespeare Illustrated’ (1753–54). She also wrote ‘Memoirs of Harriot Stuart’ (1750); ‘The Female Quixote,’ popular in its day and somewhat injudiciously praised by Fielding and Johnson (1752); ‘Sophia,’ a novel (1763); ‘The Sisters,’ a comedy (1769), etc. She was the friend of Dr. Johnson and Samuel Richardson, from the former of whom she received much encouragement.

LENNOX, Patrick Joseph, American university professor: b. Nurney, County Kildare, Ireland, 12 Aug. 1862. He was educated at Rockwell College, Saint Patrick's College, Carlow, and University College, Dublin. In 1886 he became lecturer at University College, Dublin, and professor of classics and English at the Dominican Women's College of the same city. Subsequently he became senior lecturer in the intermediate department of Blackrock College and chief professor of the evening courses at University College, Dublin. Since 1907 he has been professor of the English language and literature at the Catholic University of Washington, D. C. He has made particular studies of economic and sociological questions and in 1910 was sent to London by the Department of State to attend the International Congress of Chambers of Commerce. In the same year he investigated trade conditions in Europe as special agent of the United States Department of Commerce and Labor. In 1911 he was sent by President Taft to represent the United States at the International Congress on Alcoholism. His works include ‘The Victorian Era in Ireland’ (1887); ‘Mythology of the Ancients’ (1888); ‘Early Printing in Ireland’ (1909); ‘Women Writers of English in the Fifteenth Century’ (1910); ‘The National University of Ireland’ (1911); ‘Addison and the Modern Essay’ (1912). He is a contributor to ‘The Catholic Encyclopedia,’ the ‘Encyclopedia Americana,’ the *North American Review*, the *Catholic World*, the *Catholic Educational Review*, etc., and editorial writer on the *Washington Post*.

LENNOXVILLE, Canada, village in Sherbrooke County, province of Quebec, 105 miles southwest of the city of Quebec, at the confluence of the Massawippi and Saint Francis rivers, and on the Grand Trunk and Canadian Pacific railroads. Bishop's College and Bishop's School are located here. Pop. 1,211.

LENOIR, lĕ'nwär', **Alexander Albert,** French architect: b. Paris, 21 Oct. 1801; d. there, 17 Feb. 1891. He was educated at the Collège Bourbon and under Debret at the École des Beaux-Arts. Through the publication of ‘Projet d'un musée historique’ (1883), he secured the adoption of his plan to unite the Palais des Thermes and the Hôtel de Cluny as the Musée de Cluny and received the appointment as an architect to execute the work. He became life-secretary of the École des Beaux-Arts in 1862 and a member of the Académie des Beaux-Arts in 1869. His work in the reproduction of mediæval buildings was particularly notable. Author of ‘Instruction sur l'architecture monastique au moyen âge’ (2 vols., 1852–56); ‘Statistique monumentale de Paris’ (1861–67), etc.

LENOIR, lĕ-nōr, N. C., town and county-seat of Caldwell County, 70 miles northwest of Charlotte, on the Carolina and Northwestern Railroad. The Davenport Female College is located here and Blowing Rock, whose elevation is 4,500 feet, is near. There are gold and mica mines and the surrounding country is interested in agriculture and fruit-raising. The town has tanneries and planing-mills and manufactures of furniture and cotton stuffs. Pop. 3,364.

LENOIR CITY, Tenn., city of Loudon County, 23 miles southwest of Knoxville, at the confluence of the Tennessee and Little Tennessee rivers and on the Southern Railroad. It has abundant water power and operates carworks, lumber yards, a flour mill and cotton spinning and knitting factories. Pop. 3,392.

LENOIR ENGINE. See INTERNAL COMBUSTION ENGINE.

LENORE, lā-nō'rĕ, ballad by Bürger (1773), named from its heroine and based on the old Slavic legend that the tears of a maiden shed over the death of her betrothed may cause him to return from the grave in the guise of a vampire, carry her away to the graveyard and destroy her, unless she should be rescued in some miraculous fashion. The name is also used in two poems by E. A. Poe, ‘The Raven’ and ‘A Pæan’ (1831), afterward rechristened ‘Lenore.’

LENORMANT, lė-nôr-mäṅ, **Charles,** French archæologist and art historian: b. Paris, 1 June 1802; d. Athens, Greece, 24 Nov. 1859. He became inspector of fine arts in 1825, professor at the Sorbonne in 1835 and was professor of Egyptian archæology in the Collège de France from 1848 till his death. Among his writings are ‘Des artistes contemporains’ (2 vols., 1833); ‘Questions historiques’ (2 vols., 1845); ‘Musée des antiquités égyptiennes’ (1842); ‘Le trésor de numismatique et de glyptique’ (5 vols., 1836–50); ‘Elite des monuments ceramographiques’ (1844–57, with de Witte).

LENORMANT, François, French historian and archæologist, son of Charles Lenormant (q.v.): b. Paris, 17 Jan. 1837; d. there, 10 Dec. 1883. He was one of the foremost of French Assyriologists and from 1874 was professor of archæology at the Bibliothèque. Among his very numerous works are ‘Recherches archéologiques à Eleusis’ (1862); ‘Essai sur l'organisation politique et économique de la monnaie dans l'antiquité’ (1863); ‘Manuel d'histoire ancienne de l'Orient’ (1868); ‘Chefs-d'oeuvre de l'art antique’ (1867–68); ‘Les Tableaux du musée de Naples’ (1868); ‘Histoire du peuple juif’ (1869); ‘Les sciences occultes en Asie’ (1874–75); ‘Les origines de l'histoire d'après la Bible et les traditions des peuples orientaux’ (1880–82); ‘Monnaies et médailles’ (1883); ‘La Grande-Grèce’ (1881–83).

LENOX, James, American philanthropist: b. New York, 19 Aug. 1800; d. there, 17 Feb. 1880. He was educated at Columbia, and in 1839, on the death of his father, a wealthy Scottish merchant of New York, he inherited a fortune of several millions and 30 acres of land between Fourth and Fifth avenues. After his father's death he retired from business and devoted his time to study and the collection of fine books, statuary and painting. After some years he became the possessor of the most extensive private collection of books and paintings in the United States. In 1870 he erected a large and costly building on Fifth avenue, between 70th and 71st streets, to contain his collection. On 23 May 1895 the Lenox Library was consolidated with the Astor Library and the Tilden Trust to form the New York Public Library. He founded the Presbyterian Hospital, his gifts to it amounting to $600,000. He also made important gifts to Princeton College and Seminary, and gave liberally to numerous churches and charities connected with the Presbyterian Church.

LENOX, Mass., town in Berkshire County, on the New York, New Haven and Hartford Railroad, about six miles south of Pittsfield and the same distance from the boundary line between New York and Massachusetts. It was settled in 1750 and named in honor of Charles Lenox, Duke of Richmond. The town includes the villages of Lenoxdale and New Lenox. It is noted for its beautiful scenery and healthy climate. Within the town limits are Laurel and Mahkeenac lakes and spurs of the mountains called the Ledge, Perry Peak, Bald Head and Mattoon Hill. This locality is largely residential; the industries which contribute to the wealth of Lenox are located mainly in the large cities. Many noted people have been residents of Lenox, among others Nathaniel Hawthorne, Henry Ward Beecher and Fanny Kemble. The government is administered by town meetings. Pop. 3,060.

LENS, lönz, France, city in the department of Pas-de-Calais, nine miles northeast of Arras on the Déule and on the Lens Canal. It is an important coal-mining centre, has iron, steel and engineering works and manufactures sugar, steel cables and soap. It is an ancient town and was at one time fortified. It was the scene of a victory by the French under Condé over the Spaniards under Archduke Leopold William, 2 Aug. 1648. It was occupied by the Germans during the European War beginning August 1914, and was the scene of severe fighting at both the beginning and end of the struggle, being retaken by the Allies 3 Oct. 1918. Pop. 31,746.

LENS, a transparent body, generally glass, which refracts the rays of light convergently or divergently. Converging lenses, properly speaking, are called positive (trade designation plus, +), because they bring rays of light to an actual focus, thus forming a real image. Converging lenses give, under suitable conditions, a magnified image of an object, and one or both of their bounding polished surfaces are convex. The fact of their being thicker in the middle than at the edges distinguishes them from diverging lenses. Diverging lenses are called negative (trade designation, minus, —) because they tend to cause the rays of light to diverge and form, under all conditions, a virtual, reduced image of an object. One or both of their surfaces are concave and they can be distinguished from converging lenses by their being thinner in the middle than at the edges. These two classes of lenses are each divided into three leading types. Those of the positive or convex class are (I) double or bi-convex; (II) plano-convex; (III) convex-meniscus (trade term, periscopic-convex). Those of the negative or concave class are (IV) double or bi-concave; (V) plano-concave; (VI) concave-meniscus (trade term, periscopic-concave). (See Fig. 1). Convex lenses converge parallel rays, as shown in Fig. 2, to a point (*c*) called the principal focus or focal point, and the distance from a certain point (*b*), called a principal point, which is usually within the lens, to the focal point (*c*) is the equivalent focal length. The straight line (*d b c*) which passes through the middle of the lens, joining the centres of the curvature of the two surfaces, is called the principal axis.

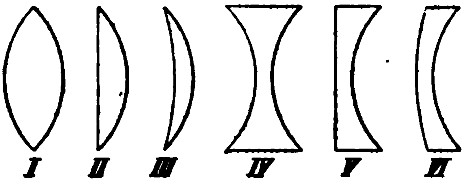


FIG. 1.

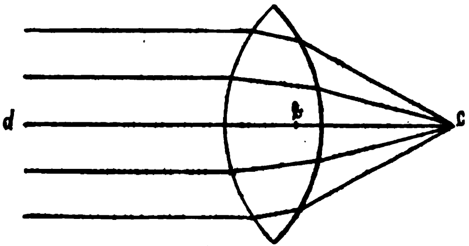


FIG. 2.

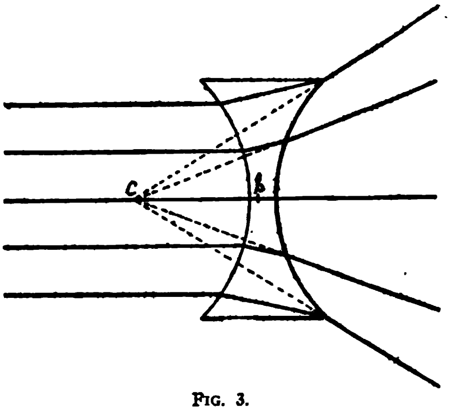


FIG. 3.

For brevity, the word "focus" is often used instead of focal length. In a concave lens, the action on parallel rays is opposite to that of a convex lens; instead of converging the light, it diverges the rays away from the axis, as shown in Fig. 3. The imaginary extension of the diverging rays should meet at *c*, and when, as in the case of the convex lens, the incident rays are parallel, the distance from the virtual focus *c* to the principal point *b* is the equivalent focal length. It will be noticed from the diagrams that the rays of light entering the substance of the lens are always bent toward the thickest part of the lens. Generally speaking, the real or virtual focus increases with the increase of radius of curvature of the polished surfaces. The power of any lens is the quotient obtained by dividing unity by the equivalent focal length. A lens is said to be neutralized when combined with one of equal and opposite power, giving the effect of a plane glass. The distinctness of the image formed by a simple lens depends mostly on the extent to which the spherical aberration and the chromatic aberration are present, the aberrations being greater as the ratio of diameter to focal length increases in a lens of any given type. Spherical aberration of a lens is caused by the rays meeting at different intervals along the axis instead of combining at one point. In Fig. 4, *ol* is the spherical aberration. Chromatic aberration is due to the separation of the light into its different colors, thus causing, in the case of a convex lens, the violet rays to meet at a point *v* nearer the lens than do the red rays at point *r*. In Fig. 5 *vr* is the chromatic aberration. Both of these defects are corrected in achromatic lenses. The process by which this is accomplished is the combining of two or more lens forms of different kinds of glass which have differing angles of refraction. These are accurately fitted together and cemented into one piece. A very common combination is a convex *crown* glass with a concave *flint* glass. A still better combination is a central disc of flint glass with a crown disc on each side of it — all being optically ground so as to correct both chromatic and spherical aberration.

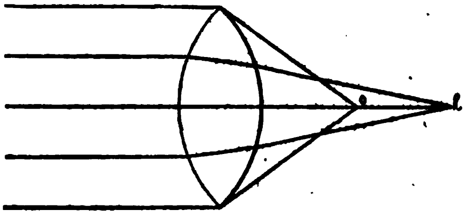


FIG. 4.

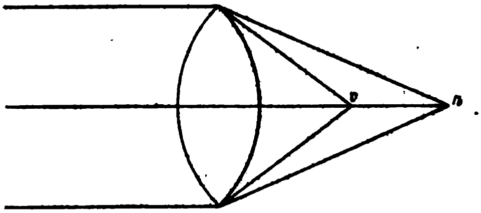


FIG. 5.

Up to the present we have only considered lenses in which the curved surfaces are spherical, and for this reason are called spherical lenses. There are, however, other forms of lenses used, especially for the correction of defects in vision, principally astigmatism, of which the most important has one, sometimes both, of the curved surfaces cylindrical. These are called cylindrical lenses, or cylinders. In these lenses a line drawn along the summit of curvature, parallel to the axis of the imaginary cylinder, is called the axis, and must be distinguished from the principal axis of a spherical lens. (Fig. 6). When the lens has two cylindrical surfaces, with the axes at right angles, it is called a «crossed cylinder»; if one of the surfaces is spherical and the other cylindrical, the lens is called a «sphero-cylinder.» Another form of lens which has come into use in recent years is the toric (toroidal) lens on which one surface is toroidal, the meridians of the surface are at right angles to each other and have radii of different curvature. Its form is illustrated by a section of a bicycle tire. (Fig. 7). These lenses are much in use for lighthouses, being

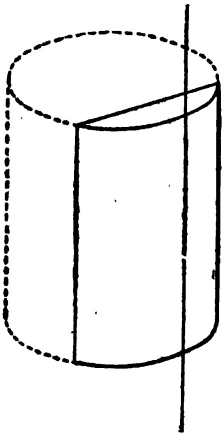


FIG. 6.

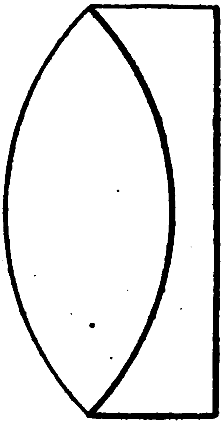


FIG. 8.

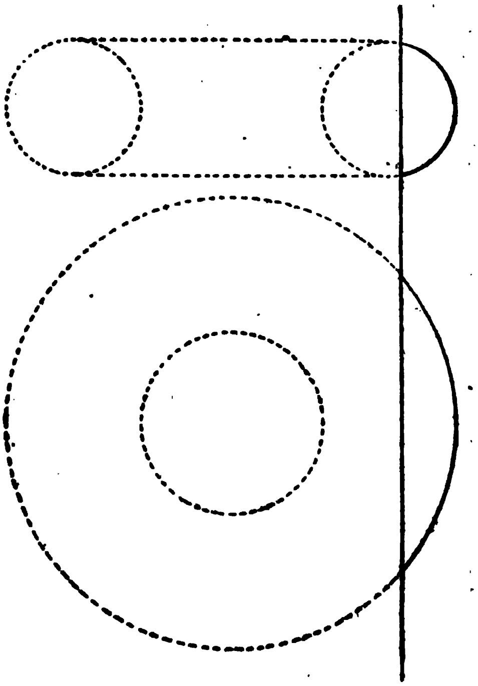


FIG. 7.

usually built up by a series of concentric rings of almost prismatic form.

Type lenses are combined for economic use generally in four ways: (1) to produce an enlarged image, as in the reading-glass and microscope; (2) to produce a smaller image, as in the photographic camera; (3) to gather and project rays of light in a cylindrical beam, as in the lens of a lighthouse, or the condenser of a stereopticon; (4) to condense and project to a focal point, as in the burning glass. The lenses for telescopes, microscopes, cameras and stereopticons require to be ground and polished with the most exquisite accuracy. In a somewhat less degree accuracy of form and finish is required in spectacle lenses. The following list comprises the usual forms of lenses in commercial use:

Achromatic Lens.— In its simplest form is a combination of a converging crown glass lens and a diverging flint glass lens so proportioned that the chromatic aberration is corrected for two colors. These lenses are generally combined by a thin transparent cement which makes them together appear and operate as one lens. (See Fig. 8). They are also made up of three, four or five lenses cemented together.

Aplanatic Lens.—A lens or a lens system which is free from spherical aberration.

Apochromatic Lens.—An achromatic lens in which the chromatic aberration is corrected for three colors and the spherical aberration is also very perfectly corrected.

Bi-focal Lens.—A double focus spectacle lens first introduced by Benjamin Franklin, and now commonly made by adding to or inserting a segment in the lower half of the lens.

Bull's-eye Lens.—A plano convex lens of relatively short focus used for illuminating purposes, generally in a hand lantern.

Cataract Lens.—A short focus convex lens to aid vision after the removal of the crystalline of the eye for cataract.

Coddington Lens.— Originally the central portion of a glass sphere but is now generally made a single lens of considerable thickness with convex surfaces, with a circular groove to cut out the marginal rays.

Collective Lens.— In a microscope or telescope eyepiece the large lens nearest the objective.

Compound Lens (a trade term).—A lens in which combinations of plano, spherical, cylindrical or toric surfaces are made, sometimes to the extent of obtaining a prismatic effect.

Condensing Lens.—A convex lens or a system of lenses for concentrating light to a point or on a surface.

Coquille Lens (trade term).—A piece of colored glass of uniform thickness and having concentric spherical surfaces.

Crossed Lens.— Either a double convex or double concave lens with the radii of curvature in the proportion of 1 to 6, and giving the minimum amount of spherical aberration.

Crystalline Lens.— The natural double convex fluid lens in the eye situated behind the iris and aiding to form the image on the retina.

Demonstration Lenses.—A series of lenses of pronounced curvatures to illustrate the various types of lenses.

Doublet Lens.—A combination of two separate single lenses. These lenses may be either simple or compound.

Eye-lens.— The lens nearest the eye in eye-pieces (oculars) used for microscopes and telescopes.

Eyeglass Lens.—A spectacle lens used to aid vision. As a single lens it is held in position by muscular contraction. The eyeglass with lenses for both eyes is generally accepted to mean the form which is held in position by clamping upon the nose (French, *pince-nez*), or it may be attached to a handle.

Finder Lens.—A lens or a combination of lenses attached to a camera to locate the boundaries of the field of view.

Fluid Lens.—A lens produced by filling the space formed by two transparent surfaces with a suitable liquid.

Fresnel Lens.—A lens formed of a central plano convex or toric convex lens bounded by ring-shaped prisms and lenticular prisms, used to project the rays from a lamp, as in a lighthouse or railway signal light.

Immersion Lens.—A microscope objective of high power, the front lens of which is connected by fluid to the cover glass of an object, thus giving increased angular aperture.

Kryptok Lens.—A spectacle lens compounded by countersinking the ordinary lens and filling the aperture with glass of a different angle of refraction and fusing the two into one in the electric furnace.

Magnifying Lens (Magnifier).—A lens or a series of two or three lenses used to increase the apparent size of an object, mounted so that one, two or three may be used separately or superposed one upon the others, and in convenient form for the pocket.

Pebble Lens (trade term).—A spectacle lens made of rock crystal which is harder than glass and has a different angle of refraction.

Photographic Lens (also photographic objective).— A lens or a combination of lenses designed for photographic purposes. It is made in a great variety of types, the simplest being the single achromatic convex meniscus lens. The form in most common use is composed of two separated achromatic menisci, with their concave surfaces toward one another, known commercially as symmetrical, rectilinear or aplanat. The portrait lens, another type, generally of large diameter, having great light-gathering power, is composed of two separated achromatic lenses, one cemented and the other uncemented (Petzval type). The most modern photographic lens is the anastigmat, invented by P. Rudolph, which is free from astigmatism, a fault present in all earlier types. The new varieties of optical glass made in Jena were first successfully employed in these lenses, by means of which greater perfection in other directions was also attained.

Punktal Lens.—A spectacle lens corrected for astigmatism over a field of 80 degrees. See SPECTACLES.

Spectacle Lens.—A lens used to correct vision and when two are combined by a bridge which rests on the nose and provided with bows which clasp the temples is now generally termed spectacles.

History.— The early history of lenses is quite vague. While the magnifying property of glass globes filled with water and presumably of glass beads was known, there is no authentic information that lenses were made and used. There is in the British Museum a piece of rock-crystal about the size of a modern spectacle lens, cut to a plano convex form which was found by Layard during the excavations at Nimroud. Instead of having a spherical surface, it is made up of a series of facets and the crystal is permeated by cloudy striæ. Alhazen, who died about 1052, first described the magnifying effect of simple lenses. Spectacle lenses were well known in the 13th century, and their invention is credited to Salvino d'Armato degli Armati, about 1255. The combination of two single lenses, thus forming a compound microscope, for the purpose of magnifying objects, is believed to be due to Hans and Zacharias Janssen of Middleburg, Holland, about 1590. The discovery of the telescope, which is credited to Galileo, about the year 1610, was in its original form a combination of convex lens of long focus with a concave lens of short focus, and this form is still retained in the ordinary opera glass, which is designated as a Galilean telescope. The achromatic lens was the next important invention and was made by Dolland in England in 1758. The making of lenses was revolutionized in 1886 by the announcement of 19 new kinds of glass by the Jena Glass Works of Jena, Germany. In 1888, 24 other kinds were placed on the market; and eight more in 1892. Not all of these were suitable for making lenses, but some of them proved superior and new combinations with former glasses were possible, resulting in some of the most remarkable instrumental lenses theretofore produced. In July 1914 a practical glass maker was added to the force of the Bureau of Standards of the United States, and this bureau has since made some of the finest optical glass ever produced. See Glass; Jena Glass; Lighthouse; Microscope; Optics; Photography; Stereopticon; Telescope. Consult Bolas, T., and Brown, G. E., 'The Lens' (New York 1902); Fraprie, F. R., 'How to Choose and Use a Lens' (Boston 1915); Hovestadt, H., 'Jena Glass, and Its Scientific and Industrial Applications' (London 1902); Prentice, C. F., 'Ophthalmic Lenses and Prisms' (Chicago 1917); Thorington, J., 'Refraction and How To Refract' (Philadelphia 1914); United States Bureau of Standards Reprint 122, 'The Resolving Power of Objectives' (Washington 1909); Wood, R. W., 'Physical Optics' (New York 1911).

LENS, *in geology.* See Bed.

LENSTRÖM, län'strĕm, **Carl Julius,** Swedish clergyman, poet and critic: b. Gefle, 9 May 1811; d. Vester-Löfsta, 6 April 1893. He was educated at the University of Upsala and took orders in 1834. He was instructor in the history of literature at Upsala in 1836–43, and lecturer in philosophy at the Gymnasium at Gefle in 1843–45. From 1845 he was rector at Vester-Löfsta. His literary productions included history, fiction, poetry, philosophy and theology. Author of 'Bidrag till den svenska äesthetikens historia' (1840); a Swedish church history, 'Lärobok i allmänna och svenska Kyrkohistorien' (1843); in verse 'Cromwell' (1860); and 'Gustaf II Adolf' (1860); 'De fyra Stånden, taflor ur svenskt sedelif' (1865), etc.

LENT (from Anglo-Saxon *Lenct,* spring), the spring or vernal fast of the Christian Church as observed, in preparation for Easter, by members of the Greek, Roman and Anglican churches. The original fast of spring which preceded Easter was of 40 hours' duration, this being the number of hours that intervened between the death and resurrection of Christ. Additional days were added, their number varying in different churches. Cassian (420 A.D.) says six or seven weeks was the period in the several churches, but none exceeded 36 fasting days. He affirms that the observance of Lent is not primitive. The historian Sozomen (440 A.D.) writes of the fast "The Quadragesimal fast before Easter some observe six weeks, as the Illyrians and Western churches; others make it seven weeks, as the Constantinopolitans and neighboring churches." In the first three or four centuries much latitude was allowed in the observance of Lent; Chrysostom recommends, but does not enforce it, insisting on the prior necessity of good works and alms-giving. Distinction of foods was not made in primitive times, when the greatest ascetics ate meat in Lent, though they abstained from eating until the evening. In its present form it dates from the 9th century. See Fasting; Ash Wednesday; Holy Week.

LENTHALL, William, English parliamentarian: b. Henley-on-Thames, June 1591; d. Besselsleigh, 9 Nov. 1681. He was educated at Oxford, was called to the bar at Lincoln's Inn in 1616 and became a bencher in 1633. He was member of Parliament for Woodstock in the Short Parliament, April 1640, and was selected by Charles I to be speaker of the Long Parliament, beginning 3 Nov. 1640. He was a man of much pliancy of nature and was bitterly criticized as a time-server in the troubles of his day; but on the occasion of the appearance of Charles I in the House of Commons, 4 Jan. 1642, for the purpose of arresting five members, he won the gratitude of Parliament by his dignified refusal to disclose their whereabouts. He was shortly afterward granted the sum of £6,000 for expenses connected with "strict and long attendance" in the House. He was appointed master of the rolls 22 Nov. 1643 and was a commissioner of the great seal in 1646–48, having sided with Parliament at the outbreak of the rebellion, although he was probably at heart a royalist. He put the question for the king's trial from the chair, in the belief, he afterward maintained, that the majority were in favor of clearing him. While he confessed that much of his conduct was based upon personal cowardice he nevertheless had the courage to use his casting vote to save the lives of the Earl of Norwich, 8 March 1649, and Sir W. D'Avenant, 3 July 1650, both royalists. He was speaker of the first Parliament under Cromwell in 1654 and was member from Oxfordshire in 1656, and was again speaker of the Long Parliament 1659. He aided the restoration of the Stuarts, but was not returned to the House of Commons and was deprived of his office of master of the rolls by the king. He was permitted to appear at court after testifying against the regicide, Thomas Scott.

LENTICEL, *in botany,* a mass of roundish cells characterized by having a greater or less likeness in shape to a double-convex lens. It is exemplified in the inner bark of trees and woody plants of mature age, where a lenticel underlies each of the many openings through the bark, usually denoted externally by wart-like excrescences, by which the air enters to furnish oxygen and other gases to the interior of the wood, where connected openings between the cells carry the gases to all parts of the plant — a provision very necessary to its health. These openings at the lenticels are partly closed in winter by a growth of corky, cortical cells, but reopen in spring and resume their supply of air to the reviving life of the plant.

The same name is given, in physiology, to one of the follicles at the base of the tongue that secrete and supply to the tongue the moisture (mucus) that it requires in order to exercise the sense of taste, and to perform its function generally.

LENTIL, a European leguminous plant (*Ervum lens*), closely allied to the tares and vetches. Lentils are cultivated in southern Europe in two varieties — the large garden lentil and the common field lentil. for the sake of their seeds contained in small pods. The straw of lentils is good food for cattle and sheep, and when mixed with vetches, and sowed as food, is excellent fodder. As food for man lentils are very nutritious, and in Egypt, Syria, Mexico, etc., are an important article of diet. They are used in soups, etc., in England and the United States, but not to a great extent.

LENTIL, *in geology*. See BED.

LENTINI, lĕn-tē'nē, or **LEONTINI** (anc. *Leontium*), Sicily, city in the province of Syracuse, 18 miles southwest of Catania by rail, six miles from the coast, and on Lake Lentini, the largest body of water in Sicily. The town was founded by Chalcidians, from Naxos, 729 B.C. It was captured by Hippocrates of Gela in 498 B.C., appears to have been unimportant in Roman times, was destroyed by the Saracens, 848 A.D., and was practically leveled by the earthquake of 1698. It was the birthplace of Euclid. The modern town manufactures earthenware and is a market for grain, oil, wines, flax, fish and game, and cattle. The neighborhood is highly malarial. Pop. 22,904.

LENTULUS, lĕn'tū-lŭs, the name of a patrician family of Rome of the Cornelian gens. Several of its members distinguished themselves by their virtues and services, while others were less honorably conspicuous. PUBLIUS LENTULUS SURA was quæstor under Sulla (81 B.C.), prætor (75 B.C.) and consul (71 B.C.). He was expelled from the senatorial order by the censors, but became prætor again in 63 B.C., while Cicero was consul. As one of the accomplices of Catiline, Lentulus was indicted in the conspiracy and put to death in prison. LENTULUS SPINTHER, one of the most luxurious and ostentatious men of his age, was curule ædile (63 B.C.), prætor (60 B.C.) and consul in 57, when he was instrumental in procuring Cicero's recall. He was governor of Cilicia and Cyprus from 56–53 B.C. Later he became a partisan of Pompey, but was pardoned by Cæsar and joined Brutus and Cassius when they took the field after the assassination of Cæsar. L. CORNELIUS LENTULES CRUS, who was the chief accuser of Publius Clodius for violating the mysteries of the Bona Dea. He became prætor in 58 B.C.; consul in 50 B.C., and in this capacity bent all his efforts toward encouraging an armed resistance to Cæsar. Upon Cæsar's victory, he fled to Greece; and when Pompey's defeat at Pharsalus made it impossible for Lentulus to return, he embarked for Rhodes. After wandering through Cyprus, he went eventually to Egypt where he was put to death by Ptolemy.

LENZ, Oskar, German explorer and geographer: b. Leipzig, 18 April 1848. He studied at the University of Leipzig, was appointed to the Austrian Geological Institute and was engaged in expeditions to Croatia, Hungary and Bohemia. He was in West Africa on a scientific expedition for the German African Company in 1874–77; and in 1880 he succeeded in crossing the western part of Sahara and reaching Timbuktu. The Mahdi revolt having cut off Junker, Casati and Lupton, he in 1886 organized and headed the relief expedition. He was appointed professor of geography at the German University of Prague in 1887, was rector there in 1902–03 and retired in 1909. He collaborated with Hochstetter in the preparation of 'Die zweite deutsche Nordpolfahrt' (1874). Author of 'Skizzen aus Westafrica' (1878); 'Timbuktu: Reise durch Marokko, die Sahara und den Sudân' (2 vols., 1884); 'Wanderungen in Afrika' (1895); 'Ueber Geld bei Naturvölkern' (1895); 'Marokko, Geschichte, Land, und Leute' (1907), etc.

LEO, the name of 13 popes, as follows:

LEO I, Saint (surnamed THE GREAT), Pope from 440–461: b. Rome or Tuscany; d. Rome, 10 Nov. 461. Of the Roman popes only Leo I and Gregory I received the designation «Great.» The earliest definite information concerning Leo reveals him in 429 a deacon of the Roman Church under Pope Celestine I, and already a man of considerable repute for learning and sagacity. His connection with Gaul is shown by the fact that Cassianus wrote 'De Incarnatione Domini contra Nestorium' (430 or 431) at the suggestion of Leo and dedicated the work to him. In 440 Leo was temporarily in Gaul, sent there by Emperor Valentinian III to adjust the dispute between the general Aëtius and the chief magistrate Albinus, when Pope Sixtus III died, 19 August. While still absent Leo was elected Pope and upon his return was consecrated, 29 Sept. 440. He set about securing unity in the Church and in 443 began measures for the suppression of the Manichæans and other heretics, succeeding in returning many to the Church and in banishing others. He greatly strengthened the central authority of the Church and a signed evidence of his success exists in the edict of the Emperor Justinian III which directed that the authority of the bishop of Rome was necessary for any innovations, and that «the decree of the apostolic see should thenceforth be law.» Leo's correspondence with Turibius of Astorga in 447 culminated in the denouncement of Prescillianism by the Church in Spain; in 449 he held a council in Rome against the Eutyches, whose council held earlier in the year Leo denounced as the «Robber Synod»; and in 451 he addressed to the General Council at Chalcedon, over which he presided by legates, his famous «dogmatic letter» to Flavian, defining the doctrine of the Incarnation. His letters are of great importance in Church history and 143 of them are in existence, together with 30 written to him. When Attila threatened to invade Italy, after the fall of Aquileia, Valentinian sent Leo to dissuade the invader from his purpose and the persuasive powers of the Pope made the mission successful. Leo also saved Rome from being burned by Genseric in 455 and secured the pledge of the vandal to refrain from murder and to spare the three oldest basilicas in his pillage of the city. His achievements in the direction of establishing the authority of the successors of Saint Peter on a monarchial basis, and the strength of his administration of Church proceedings in Africa, Gaul and Spain, no less than in Rome, marked his rule as of exceptional importance. He was famous also for his sermons, which were brief but excellent, and upon which many of the lessons in the Roman breviary are based. His name day is 11 April. His sermons and letters were edited by Ballerini (Venice 1753–57). Consult Arendt, ‹Leo der Grosse und seine Zeit› (1835); Gore, ‹Leo the Great› (1880).

LEO II, Saint, Pope (August 682 to June 683): b. Sicily; d. Rome, 28 June 683. He was elected Pope a few days after the death of Pope Agatho, 10 Jan. 681, but was not consecrated until 17 Aug. 682. He confirmed the decrees of the Sixth Œcumenical Council, held in Constantinople in 680–81 under the presidency of the legates of Pope Agatho, and which condemned Pope Honorius I for not summarily suppressing heresy. Leo wrote several letters on the subject, explaining the decree and abjuring his bishops to subscribe it; making it clear, however, that his anathematizing of Honorius was not an accusation of his teaching heresy, but of his showing too great leniency in dealing with it. The letters are particularly important in their bearing upon the infallibility of the Pope. He succeeded in settling the difficulties existing between the sees of Rome and Ravenna, the archbishops of Ravenna wishing to be independent of the direct jurisdiction of the Pope. Leo abolished the tax formerly imposed upon the archbishops when they received the pallium; but, while insisting that they come to Rome for consecration, limited their exacted visit to eight days and permitted their yearly homage to the Pope to be presented through a delegate. His name is connected with the improvement of the Gregorian Chant and he was instrumental in raising the grade of church music. His day is 28 June.

LEO III, Saint, Pope (December 795–May 816): b. Rome; d. there, 25 May 816. He succeeded Adrian I, 26 Dec. 795 and was consecrated the next day. Upon his election he sent to Charles the Great (Charlemagne) the keys of Saint Peter's and the standard of the city of Rome in acknowledgment of the suzerainty of the king. He received in return letters of congratulation and a rich share of the treasure captured by the king from Avars, and was thereby enabled to deal generously with the churches and charitable institutions of Rome. A conspiracy formed by two nephews of Adrian I, to deprive Leo of the papacy by destroying his eyes and tongue, thus rendering him unable to fill the office, was brutally attempted during a papal procession in 799, but Leo succeeded in escaping with minor injuries and afterward made his way to Charles at Paderborn. He was received with respect and later escorted in state to Rome where he was highly acclaimed. The conspirators against him were banished. In 800 Charles returned to Rome and was crowned by the Pope emperor of the Romans. While the subordinate position of Leo became thus clearly defined the result was to ensure the protection of the emperor for the Roman Church and Christendom against the heathen, and the arrangement continued satisfactorily during Charles' lifetime. Upon the accession of Louis conspiracies were again formed against him, but Leo was warned in time and the conspirators were seized and punished. However, the question of sovereign jurisdiction in Rome was again revived and Leo died before a decision was reached. He was known as a benefactor of the poor and a patron of art. Among the mosaics made under his direction is one in the Lateran, Rome, showing Saint Peter giving the pallium to Leo III and the standard to Charles.

LEO IV, Saint, Pope (April 847–July 855): b. Rome; d. there, 7 July 855. He succeeded Sergius II, and was consecrated 10 April 847 without waiting for the consent of the emperor because of an impending attack of the Saracens upon Rome. He thoroughly repaired the walls of the city, entirely rebuilding 15 of the great towers, and enclosed Vatican Hill by a wall, a precaution not previously taken. The fortified portion of the city was named *Civitas Leonina* in his honor. He rebuilt Portus for the benefit of Corsican exiles driven from their homes by the Saracens, and fortified other Roman towns. He repaired the damage done to Saint Peter's and other Roman churches in the Saracen raids of 846. He held three synods, at one of which Louis II was crowned emperor. His alleged miracle of extinguishing a fire by prayer is pictured in Raphael's work in the Sala dell' Incendio at the Vatican.

LEO V, Pope: d. probably 6 Dec. 903. He was a Benedictine monk who, in 903, succeeded Benedict IV, but was imprisoned by his chaplain Christopher, and died soon after.

LEO VI, Pope: d. probably 3 Feb. 929. He succeeded John X, 6 July 928, and is said to have been put to death by Marozia.

LEO VII, Pope: d. 13 July 939. He succeeded John XI, son of Marozia. He successfully negotiated a peace between Hugo, king of Italy, and Alberic, Duke of Rome, the son of the celebrated Marozia, and is reported to have been an irreproachable man and zealous ecclesiastic. His successor was Stephen IX. Consult Gregorovius, F., ‹History of the City of Rome in the Middle Ages› (Vol. III, London 1895).

LEO VIII, Pope (July 964–Feb.–April, 965): d. 965. He was intruded in the pontificate on the pretended deposition of John XII, in 963, under the patronage of Otho I, but on Otho's withdrawal John re-entered Rome, and drove away Leo. John's death occurring soon after, Benedict V was chosen Pope. The Emperor Otho subsequently took Rome, and after the banishment of Benedict again intruded Leo, who shortly after died. He is regarded as the true Pope from the abdication of Benedict V in July 964 until his death between February and April of 965. Documents purporting to vest in the emperor the nomination of popes and bishops, supposed to have been given by Leo, are generally considered forgeries.

LEO IX, Saint (BRUNO), Pope (1049–54): b. Egisheim, near Colmar, on the borders of Alsace, 21 June 1002; d. Rome, 19 April 1054. He came of a noble family and through his father was second cousin to Emperor Conrad II. He was educated at Toul, became canon there and in 1026 bishop. He rendered valuable political services to his cousin Conrad II, and to Henry III, and became famous for his wide learning and his zeal in correcting abuses. Upon the death of Pope Damascus II, in 1048, Bruno was elected Pope and was consecrated as Leo IX, 12 Feb. 1049. He put down an effort of ex-Pope Benedict IX to seize the papal chair, and immediately set about a reorganization of financial affairs. At the Easter synod of 1049 he initiated his warfare on two notorious evils, simony and clerical incontinence, continuing his efforts at later synods held in Rome and in the course of various progresses he made through Italy, Germany and France. In 1053 he moved against the Normans in Italy with an army composed of Italian and German volunteers, but was defeated at Astagnum near Civitella 18 June 1053 and was taken prisoner by the Norman leader, Robert Guiscard. He was confined at Benevento for 10 months, but treated with the utmost respect, and upon falling ill he was permitted to return to Rome where he died shortly afterward. His life was distinguished by his purity and strength of purpose. His name day is 19 April. Consult Hunkler, 'Leo der Neunte und seine Zeit' (1851); Milman, 'History of Latin Christianity' (Vol. III, 1903); Mann, 'Lives of the Popes in the Early Middle Ages' (Vols. IV, VI, 1910).

LEO X (GIOVANNI DE' MEDICI), Pope (1513–21): b. Florence, 11 Dec. 1475; d. Rome, 1 Dec. 1521. He was the second son of Lorenzo the Magnificent, and his father had him made a cardinal by Innocent VIII at the age of 13. When the Medici were expelled from Florence, in 1494, he spent some years in travel in Germany, France and Flanders, and made acquaintance with many eminent men, returning to Rome in 1503 and devoting himself to science and the fine arts. He was appointed by Julius II legate with the papal army, and in 1512 was taken prisoner by the French at the battle of Ravenna, regaining his liberty only after the evacuation of Milan by the French. In 1513 on the death of Julius II, he was elected Pope, and made his entry into Rome on 11 April, the anniversary of his capture at Ravenna. His pontificate of nine years is one of the most eventful of modern history, when viewed in relation to great political changes, to the revival of literature and, above all, to the Reformation. He succeeded in putting an end to the dispute between Louis XII and the court of Rome; he continued and brought to a close the Council of the Lateran; and, at a conference held at Bologna, concluded a concordat with Francis I of France. In 1517 he created the unexampled number of 31 cardinals, among whom were Cajetan, Campeggio, Trivulzio and other learned and eminent men. He planned a great war against the Turks, and resolved about the same time to complete the church of Saint Peter at Rome, and in order to raise funds for these schemes he granted to all the faithful, who should contribute by their alms, certain indulgences, the preaching of which in Saxony was one of the forces which resulted in the Reformation. Leo published his first bull against Luther in June 1520, and Luther appealed to a general council and publicly burned the bull at Wittenberg. A second bull appeared against Luther in January 1521, and the papal anathema was echoed by the doctors of the Sorbonne. At the same period war was resumed between the Emperor Charles V and Francis I, the Pope allying himself first with Francis and soon after with Charles. As an intelligent patron of literature and the fine arts, he was surrounded with many of the most distinguished men of his time. He stimulated the study of Greek and the collection of ancient manuscripts; restored the Roman University and the great Laurentian Library of Florence. His worldliness was regarded with extreme disfavor by the Church, although in matters of belief and personal moral conduct no criticism was brought against him. But he refused to recognize the serious nature of the dangers threatening the papacy, ignored the urgent need for reforms and, on the whole, was ever the prince rather than the Pope. His good qualities and many achievements were of a secular instead of a religious nature, and his pontificate was regarded as unfortunate for the Church. Consult Roscoe, 'Life and Pontificate of Leo X' (1805); Creighton, 'History of the Papacy During the Period of the Reformation' (Vols. III–V, 1882–94); Niti, 'Leone X e la sua politica' (1892); Conforti, 'Leo X ed il suo secolo' (1896).

LEO XI (ALLESSANDRO OTTAVIANO DE' MEDICI), Pope (1–27 April 1605): b. Florence 1535; d. 27 April 1605. He was consecrated bishop of Pistoria 1573, became archbishop of Florence in 1574 and entered the college of cardinals. He was appointed legate to France by Clement VIII in 1596 and there aided in suppressing the Hugenot influence at the court of Henry IV. On 1 April 1605 he became Pope. He survived only 26 days after his election.

LEO XII (ANNIBALE DELLA GENGA), Pope (1823–29): b. near Spoleto, 1760; d. 10 Feb. 1829. He entered the priesthood in 1783, was made titular archbishop of Tyre 10 years later and became a cardinal in 1816. He was bishop of Sinigaglia until 1820, when he was appointed cardinal vicar at Rome. In 1823 he succeeded Pius VII. He was a strong opponent of secret societies, such as the Free-masons and the Carbonari. Consult Artand de Montor, 'Histoire du Pape Leon XII' (1843).

LEO XIII (JOACHIM VINCENT RAPHAEL LODOVICO PECCI), Pope (1878–1903): b. Carpinto, 2 March 1810; d. Rome, 20 July 1903. His father was Count Domenico Lodovico Pecci, and his mother Anna Prosperi-Buzi. The palace in which Joachim was born was the country house of the family. Count Lodovico Pecci confided his sons, Joseph and Joachim (or Vincent) to the Jesuits of Viterbo, who very recently had been restored by Pius VII to the privileges of which Clement XIV had deprived them. In 1818, Joachim Pecci began his education in the Jesuit college of Viterbo. That devotion to the Greek and Latin classics which later gave him fame as a poet, showed itself early. At the age of 12 he was skilled in

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writing Latin verse. There still exists an epigram for the provincial of the Jesuits,—

"Oh, utinam possem Pecceius ipse sequi."

In 1824, Leo XII carried further the plans of Pius VII and reopened the Roman College of the Society of Jesus. This college is likewise known as the Gregorian University. Young Pecci entered and applied himself to his studies with so much earnestness that his health gave way, and, in 1830, though he received the highest honor — that of being chosen for a public disputation in philosophy on theses taken from the whole course,— the Prefect of Studies was obliged reluctantly to excuse him. Still he strove for that perfect health which was denied him. He was a mighty hunter and his gun,— very old-fashioned, with a barrel decorated in the Arabian manner,— is still preserved, and he walked great distances.

In 1832, Joachim Pecci took the degree of doctor, with all possible honors, chiefly recorded in the annals of the Sapienza University. In the College of Noble Ecclesiastics he studied canon and civil law. In 1837, Gregory XVI named him domestic prelate, and he became known as Monsignor Pecci. On the last day of the year 1837, he was ordained priest by Cardinal Odescalchi, the vicar-general of Gregory XVI. One of the most important epochs in the history of Monsignor Pecci is his administration of the duchy of Benevento. It was the haunt of smugglers and brigands, licensed by public opinion and supported by noble families. It had given Gregory XVI, who was a lover of justice and order, profound anxiety. At the age of 28 Monsignor Pecci was made delegate and sent to do what the Neapolitan neighbors of Benevento sneeringly said was «impossible.» Monsignor de Z'Saeclaes well says that his government of Benevento is «a little epic.» He was then called to Spoleto. From there he went to Perugia, where he busied himself in perfecting measures for the economic and educational progress of the place. The capital of Umbria still reveres him as its benefactor, and his records at Benevento and Perugia, indicated what his future was to be. Early in January 1843, he was chosen for a difficult diplomatic post, the Nunciature at Brussels; and on 19 February he was consecrated archbishop of Damietta. In Belgium the educational question was burning, and in March 1843, when Archbishop Pecci presented himself to the court of Brussels, the veteran diplomats smiled at the prospect of a struggle between the Papal Nuncio and Leopold of Saxe-Coburg, who held the winning cards. The queen's sympathies were with the Nuncio; she believed in religious education, but the feeling against the «Ultramontanes» ran high; notwithstanding, the Nuncio succeeded in gaining the goodwill of all classes and gradually overcoming rancour. This made it all the more astonishing that he should have been recalled from Brussels in 1845. In 1846 he visited London and Paris. He was destined to be archbishop of Perugia; Gregory XVI died shortly after his arrival in Rome. Pius VIII, the predecessor of Gregory, was followed by another Pius,— Cardinal Mastai Ferretti — who appreciated the value of Pecci so greatly that he felt that as archbishop of Perugia the late Nuncio to Brussels could be of more service in healing internal discord than in placating foreign kings and cabinets. He was preconized,— solemnly proclaimed in conclave,— the archbishop of Perugia, on 19 Jan. 1846, and on 26 July he made his solemn entry into the capital of the country of saint Francis d'Assisi. From 1846 to 1878 he ruled in Perugia. In the Consistory of 18 Dec. 1853, he was created cardinal. During his long episcopate, he found the world in miniature in Perugia. The growing antagonism against the Church haunted him. He was all for the things of the spirit,— the things of the mind, postulating the truth of the divinity of Christ and the reality of his birth, death and resurrection. In this line, he refutes the claims of Renan, in his 'Life of Jesus,' as eagerly as he refutes false Socialism later, in a Papal Letter.

On 7 Feb. 1878 Pius IX died. On Monday, 18 February, the cardinals met in conclave. Pecci, as Cardinal Camerlengo, walked last in the procession. On Wednesday, 20 February, by a vote of 45 out of 61, Cardinal Pecci became Pope. From 20 Feb. 1878 to 20 July 1903, Leo XIII was constantly active. He restored the Catholic hierarchy to Scotland, early in 1878, and issued his first Encyclical, *Inscrutabile,* against the forces at work for the disintegration of society — putting strong accent on the disregard of the sacramental character of marriage. In 1878–79 Leo XIII was in a most difficult position with the government of Germany. This later year marks the beginning of the decay of the Kulturkampf which strengthened the Centre party in Germany and which made the name of Bismarck detested by German Catholics at home and abroad. In 1879 came the Encyclical, *Quot Apostolici,* followed by the *Æterni Patris* — all encyclicals taking their names from the opening words. The first was aimed at that Socialism «which attacks all that has been wisely decreed by human and divine laws for the protection and ornament of life»; the second is an exposition of the claims of Saint Thomas Aquinas as a philosopher.

Another important encyclical,— it is not possible to name them all,— appeared on 12 Feb. 1880. It was the *Arcanum,* on Christian marriage. Another, 29 June 1881, was the encyclical *Diuturnum* in favor of rightful authority. «The Church,» he said, «was everywhere the friend of honest liberty; she detested tyranny.» In 1882 he strove to keep the Irish movement within legal bounds. The encyclical *Etsi Nos,* of February 1882, gave rise to the rumor that he would leave Rome, so «intolerable» had the situation become. In 1890, the world gradually learned that for six years every historical document in the Vatican had been at the service of scholars. He omitted nothing that could add to the progress of historical science. The encyclical, *Humanus Genus,* was aimed at Freemasonry, which assumes an atheistical and antireligious aspect in Latin countries.

Leo XIII was aroused to intense enthusiasm for the work of Cardinal Lavigerie in breaking down the slave-trade in Africa, and his encyclical, *In Plurimis,* 5 May 1888, is evidence of his detestation of slavery. It is addressed to the bishops of Brazil. The prudence with which Leo XIII handled the question of the Knights of Labor was due to the tact he possessed of discovering the best advisers. There were forces at work urging the condemnation of this society; but, owing to the sanity and energy of Cardinal Gibbons, Cardinal Manning and Monsignor O'Connell, rector of the Catholic University, a disaster by which suspicion and dislike to the Church might have been excited was avoided.

The relations between the late Pope and the United States of America were very close. He established the Catholic University at Washington, and constantly expressed interest in it. His solicitude for the Church in America was profoundly shown in the Apostolical letter, *Testem Benevolentiæ,* on «Americanism,» in which he paternally determines and settles a point for some time in controversy among American Catholics. In the beginning of the year 1893, Monsignor Satolli, afterward Cardinal, became the first Apostolic Delegate to the United States. This is not a diplomatic but a purely ecclesiastical office. Cardinal Satolli was succeeded by Monsignor, later Cardinal, Martinelli, and (1903) by Monsignor, later Cardinal, Falconio.

The efforts of Leo XIII to direct attention to the study of the Scriptures are historic. Perhaps of all his letters which have a diplomatic character, that written to the French in 1892 caused the greatest discussion. It was received by French Royalists with ill-concealed disgust. There is no question that the pontificate of Leo XIII was of vital value in the history of the last quarter of the century.

As a poet, Leo XIII wrote exquisite Latin verse, a translation of which has been made by the Jesuit fathers at Woodstock, Md., and a later and fuller one by Dr. Hugh Henry, of Overbrook Seminary, in Pennsylvania. Consult biographies by Bonghi (Città di Castello 1884); Wienand (2d ed., Cologne 1892); Furey (New York 1904); and also Goetz, 'Leo XIII' (Gotha 1899). His encyclicals have been published in Latin and German (Freiburg 1878–1904); and in English (New York 1902).

Maurice Francis Egan,
Envoy Extraordinary and Minister Plenipotentiary to Denmark.

LEO, lē'ō, the name of six rulers of the Byzantine empire, as follows:

LEO I (surnamed Thrax, Magnus and Makelles), Byzantine emperor: b. Thrace, about 400; d. 474. He was a military tribune at the death of Marcian in 457, was raised to the throne through the influence of Aspar, commander of the military forces, and was recognized as emperor by both Senate and clergy. Aspar, despite his great power, could not become emperor because of his being an Arian, but thought to rule through Leo. Leo, however, refused to be dominated. He steadily followed the leading of his predecessor in an effort to decrease the powers of the great nobles; defied Aspar, changing his bodyguard from the Germanic one formed to uphold Aspar's power to Isaurian; confirmed the decrees of the Council of Chalcedon and sternly suppressed the Eutychian heresy in Egypt. He repelled the Hun invasions of Dacia in 466 and 468, and in 467 had one of his generals, Authemius, elected emperor of the West. Together they equipped an expedition to conquer the pirate Vandals of Africa, sending 1,100 ships and 100,000 men; but the fleet was surprised by the Vandal king, Genseric, and nearly half of it destroyed. Leo seized upon the defeat as an excuse for having Aspar put to death as a traitor, the Vandals also being of Arian stock. The Goths, to revenge the fate of Aspar, laid waste the country as far as the walls of Constantinople. He was sometimes called Leo the Elder to distinguish him from his infant grandson, who succeeded him; and his surname Magnus was given him by the Orthodox, while the Arians called him Makelles (butcher). Consult Gibbon, 'The Decline and Fall of the Roman Empire'; 'Cambridge Mediæval History' (Vol. I, 1911).

LEO II called the Younger, grandson of Leo I, Byzantine emperor. He succeeded his grandfather under the guardianship of his father, who caused himself to be proclaimed emperor a few months afterward. He is said to have been put to death by his own father after reigning from January to November 474.

LEO III (surnamed the Isaurian), Byzantine emperor: b. probably in Isauria, but by some authorities in Germanicia, in the Syrian province of Commagene, about 680; d. 18 June 741. He entered the army of Justinian II, rose to distinction and under Anastasius II became supreme commander of the army in Asia. In 716 he marched against Theodosius III, who had been proclaimed emperor on the deposition of Anastasius II, and himself seized the crown in 717. His accession was immediately followed by the siege of Constantinople by the Saracens under the caliph Solyman, and his stubborn resistance not only compelled the enemy to withdraw after a siege variously estimated at from one to two years, but removed from eastern Europe the danger of a Saracen invasion. He then proceeded to consolidate his empire, strengthening his frontiers by the encouragement of settlers in the war-ravaged districts, and so thoroughly reorganized his armies that he was able to visit heavy defeats upon the Saracens when in 726 and 739 they again attempted invasion. He instituted civil reforms in taxation, marital and maritime laws and raised the serfs into a class of free tenants. An uprising against Leo, headed by the deposed Anastasius II, soon after the siege of Constantinople, resulted in the capture and execution of Anastasius. One of the most notable acts of Leo's reign was the order, in 726, that all image-worship in the churches must cease. (See Iconoclasts). He was supported by the aristocracy and a portion of the clergy, but opposed by most of the theologians and the monks. The edict caused a general revolution throughout the empire, and resulted in the loss of Ravenna, Rome and other portions of southern Italy and the separation of the Greek from the Latin Church. While partially unsuccessful in his attempt at religious reform the reign of Leo is on the whole noteworthy for its solid achievements. He is credited with so stabilizing the empire as to have been the means of its survival for the succeeding 500 years. Consult Gibbon, 'Decline and Fall of the Roman Empire'; Bury, 'The Later Roman Empire' (1889); Hodgkin, F., 'Italy and Her Invaders' (1892).

LEO IV (surnamed CHOZAR, or CHAZARUS), Byzantine emperor: b. 25 Jan. 750; d. 8 Sept. 780. In his time the controversy raged fiercely between the Iconoclasts, or image breakers, and their adversaries, both of whom he protected by turns. He repulsed the Saracens in Asia. He was succeeded by his infant son Constantine VI, who had been crowned the year after Leo's succession, under the guardianship of Leo's wife, Irene (q.v.). See ICONOCLASTS.

LEO V, Byzantine emperor, called the ARMENIAN, from the country of which he was a native: d. 25 Dec. 820. He rose to the rank of general by his valor, but was accused of treason, disgraced and imprisoned. Michael Rhangabus, on ascending the throne in 811, restored him to his rank, but Leo, profiting by the misfortunes of his master, headed a military revolt and was elected emperor by the troops in 813. While the chief instigator of the disaffection among the soldiers which led to his elevation Leo justified himself in so far as to meet and crushingly defeat the Bulgarians who were planning a siege of Constantinople. So thoroughly did he break their armies that a peace of 74 years ensued. He was one of the most violent of the Iconoclastic princes and was severely criticized although he was acknowledged a useful emperor. A plot devised for the benefit of Michael I caused the former emperor to be condemned to death in a fiery furnace, but his friends rescued him by assassinating Leo V before the altar on Christmas Day, and reseated him on the throne. Consult Bury, J. B., ‹History of the Eastern Roman Empire› (New York 1912).

LEO VI (the PHILOSOPHER), Byzantine emperor: b. 865; d. 911. He was the son of Basilius, the Macedonian, and in 886 succeeded to the throne jointly with his younger brother, Alexander, who, however, took no share in governing. His reign was marked by various wars with barbarian states, including the Hungarians, Bulgarians and Saracens. Thessalonica was sacked and practically destroyed and Sicily and lower Italy were overrun. Leo VI appears to have possessed small claim to his surnames, the «Wise» and the «Philosopher.» He banished his early tutor, Photius, patriarch of Constantinople, upon his succession to the throne; and upon his own excommunication from the Greek Church, following his fourth marriage — an act forbidden by the Church — he deposed Nicholas, the patriarch who had pronounced the ban upon him. His authorship of the literary productions credited to him has been questioned. Among the works bearing his name are ‹Oracula,› a poem; ‹Orationes›; ‹Basilica,› the completion of a digest of laws begun by his father; and an important treatise on military tactics, believed by some authorities to be the work of Leo III (Leyden 1612). Consult Gibbon, ‹Decline and Fall of the Roman Empire›; Bury, ‹Later Roman Empire› (1887); Oman, ‹Byzantine Empire› (1892).

LEO, Friedrich, German classical philologist: b. Regenwalde, 10 July 1851; d. 1914. He was educated at the universities of Göttingen and Bonn, and was afterward professor at the universities of Kiel, Rostock, Strassburg, Bonn and Göttingen. For many years he edited the philological journal *Hermes*. He also edited ‹Senecæ Tragædiæ› (1878–79); ‹Venantii Fortunati Opera Poetica› (1881), and was author of ‹Plautinische Forschungen› (1895); ‹Die griechisch-römische Biographie nach ihrer literarischen Form› (1901); ‹Saturnische Vers› (1905); ‹Geschichte der Römischen Literatur: Erste Band, Die Archaische Literatur› (1913), etc.

LEO, Heinrich, German historian: b. Rudolstadt, 19 March 1799; d. Halle, 24 April 1878. He was educated at the Rudolstadt Gymnasium and at the universities of Breslau, Jena and Göttingen, and in his student days was connected with the radicals of the German Burschenshaft or «Black Band,» but was early alienated from them because of their extreme measures and became a conservative. He became privat-docent at Erlangen in 1820, and in 1823 made a journey devoted to historical investigation in Italy. He was docent at Berlin in 1822–27, and for 40 years after 1828 he taught at Halle, gaining a remarkable reputation for his ability as a teacher through his powers of exposition and his unusual memory. During the closing years of his life his mind was affected. He was a collaborator on the *Jahrbücher fur Wissenschaftliche Kritik* during its existence, 1827–46. Author of ‹Lehrbuch der Geschichte des Mittelalters› (1830); ‹Geschichte der italienische Staaten› (5 vols., 1829–32); ‹Zwölf Bücher niederländischer Geschichten› (2 vols., 1832–35); ‹Die Hegelingen› (1838); ‹Lehrbuch der Universalgeschichte› (6 vols., 1835–44); ‹Vorlesungen über die Geschichte des deutschen Volks und Reichs› (1854–66); ‹Meine Jugenzeit› (1880), etc.

LEO, Leonardo, or, correctly, LIONARDO ORONZO SALVATORE DE LEO, Italian musical composer: b. San Vito degli Schiavi, now San Vito dei Normanni, near Brindisi, 5 Aug. 1694; d. Naples, 31 Oct. 1744. He was educated at the Conservatorio della Pietà dei Turchini, Naples, studying under Provenzale and Nicola Faga. While reputed to have studied under Scarlatti and Pitoni it is considered improbable, although his work obviously was influenced by them. He was maestro at the cathedral at Naples and at Santa Maria della Solitaria, became court organist and taught at the Conservatorio Saint Onofrio, Naples. He first attracted attention through his compositions for the stage, writing both comic and serious operas, but achieving his greatest success with his comic operas. His reputation as a composer, however, rests upon his sacred compositions, among which his ‹Miserere› and ‹Dixit Dominus› best illustrate his masterly style and the magnificent effects he obtained with comparatively simple means. He was the first of the Neapolitan school to gain a complete mastery over modern harmonic counterpoint. The most famous of his pupils were Pucini and Jommelli. He wrote about 60 operas of which the best known was the comic opera ‹Amor Vuol sofferenze,› also known as ‹La Finta Frascatana› (1739). Among his serious operas are ‹Demofoonte› (1735) and ‹L'Olimpiade› (1737).

LEO («the lion»), *in astronomy*, the name given to one of 12 zodiacal constellations and denoted by the symbol ♌. It contains about 100 stars visible to the naked eye, the chief star being Regulus, also called Cor Leonis, or the Lion's Heart. The sun enters the sign Leo about

21 July. Leo Minor, the Lesser Lion, is a constellation found by Hevelius about 1691. None of its stars reach the fourth magnitude. Leonides are meteors radiating from the vicinity of Leo, usually seen about 14 November.

LEO AFRICANUS (known variously as Johannes Leo; Juan Leo; Giovanni Leo, or Leone; Eliberitanus; and, among the Moors, as Al Hassan ibn Mahommed Al Wezaz Al Fasi), Moorish traveler and geographer: b. probably Granada, about 1485 or 1494; d. Tunis, about 1552. He came of a noble Moorish family, was educated at Fez, and as early as 1512 he traveled in Morocco, Tunis, Bugia and Constantine. He traveled in the Sudan and Sahara regions in 1513–15; later visited Constantinople, passing through Egypt, and afterward visited the three Arabias, Armenia and «Tartary» (probably Tabriz). He also ascended the Nile from Cairo to Assuan. In 1517 or 1520, on his return journey by sea from Egypt, he was captured by pirates and eventually presented as a slave to Pope Leo X. The pontiff soon learned of his captive's wide explorations, bestowed a pension upon him, converted him to Christianity and stood sponsor at his baptism, giving him his own name. The captive, known as Leo Africanus, acquired Latin and Greek, and in turn taught Arabic, Cardinal Egidio Antonio being numbered among his pupils. At the suggestion of the Pope he wrote his ‘Description of Africa.’ The work is stated originally to have been written in Arabic, but that manuscript is lost. However, the author himself wrote an Italian version (1526) which still exists. It was printed by G. B. Ramusio (1550), and for long was regarded as the best authority on Africa. He returned to Tunis some time after the death of the Pope. Of his other writings, his poems, a Spanish Arabic glossary and a collection of Arabic epitaphs are lost. There remains his ‘De viris quibusdam illustribus apud Arabes’ (consult Fabricius, ‘Bibliotheca Græca,’ Vol. XIII, 259–298, Hamburg 1726). The ‘Descrizione dell' Affrioa’ was published in French by Jean Temporal (Lyons 1556); in German by Lorsbach (1805); in English by Francis Moore in ‘Travels into the Inland Parts of Africa’ (1738). Several Latin editions and English translations thereof are highly inaccurate.

LEO DIACONUS, lā'o dĭ'ăk-o'nŭz (Leo the Deacon), Byzantine historian and court priest: b. Caloë, Ionia, about 950; d. about 1000. He settled in Constantinople and witnessed the era of national recovery under the emperors Romanus II, Nicephorus Phocas and John Limisces, saw Crete reconquered, the invasion of Syria and the expulsion of the Russians from Bulgaria. His history covers the period 959–75, and while not well written it is regarded as trustworthy. It constitutes a valuable supplement to Byzantine history. It was printed in ‘Corpus Historiæ Byzantinische’ (Bonn 1828).

LEOBEN, lā'ō'bĕn, Austria-Hungary, town in Styria, 44 miles by rail northwest of Graz, on the Mur. It was at one time a walled town and parts of the wall and towers remain. The old parish church has stained glass of the 14th century. It has technical schools and a widely-known academy of mining. The lignite deposits of upper Styria and the iron mines and furnaces of Vordernberg and Eisenerz give it an important trade in iron, and it has extensive iron-works. Here, 18 April 1797, Napoleon signed the secret provisional peace treaty which gave Austria the greater portion of the mainland of Venice in return for the Netherlands, which was succeeded by the Campio-Fornio Treaty. Pop. 11,504.

LEOBSCHÜTZ, lā'ōp'shüts, Germany, town in the province of Silesia, Prussia, 20 miles by rail northwest of Ratibor, on the Zinna River. The town dates from the 10th century and was the capital of the principality of Jägerndorf in 1524–1623. It has an extensive trade in flax, grain and wool and is engaged in glass-making, malting, wool-spinning and textile industries, and the manufacture of machinery, bricks and large bells. Pop. 13,081.

LEOCHARES, lē-ŏk'ạ-rēz, Greek sculptor of the 4th century B.C. He was a pupil of Scopas, and Pliny ascribes to him the sculptures on the west side of the Mausoleum at Halicarnassus. He was one of the artists privileged to make portraits of Alexander the Great. Three statues of Zeus are known to have been executed by him, and his ‘Ganymede carried off by an Eagle’ was famed throughout the ancient world. With Lysippus he produced a colossal bronze group representing Alexander at a lion-hunt. The works of Leochares are all lost, but there are numerous copies of the Ganymede, the best being that of the Museo-Pio Clementino, Rome, and another larger copy in the library of Saint Mark, Venice, and a bust of Alexander may be a copy of one of his.

LEOMINSTER, lĕm'stẽr, England, market town and municipal borough in Herefordshire, 157 miles northwest of London, on the Lug and on the Great Western and London and Northwestern railways. It is situated in a rich agricultural district and has some fine old timber houses. There is a parish church with a Norman nave and some of the finest examples of window tracery in England, restoration at different periods, however, making it an edifice of mixed architecture. The district produces wool, hops and fruit, and brewing and the manufacture of agricultural implements form the principal industries. The town received its first charter in 1554, but dates from before the Conquest, when it was the seat of a religious house. Pop. 5,737.

LEOMINSTER, lĕm'ĭn-ster, Mass., a town of Worcester County, 40 miles west-northwest of Boston, on the Nashua River, and on the New York, New Haven and Hartford and the Boston and Maine railroads. The town is well laid out, has handsome residential sections, six churches, 20 schools, a public library and over 18,000 volumes and a fine park. Leominster is well lighted with gas and electricity and has a good water supply and abundance of water power, the waterworks being municipalized. It is a busy industrial centre, the home of the comb-manufacture of the State, of piano cases and piano-fortes, has large cabinet works, paper mills, tanneries and extensive manufactures of cement, bricks, yarn, jewelry, toys, buttons, paper boxes, chemicals and hairpins. The town is surrounded by some of the most fertile farm land in the county, and horticulture and floriculture are growing industries. Leominster, settled in 1725, was part of Lancaster until 1740 when it received a charter of incorporation. A disastrous fire occurred in 1873. Pop. 19,789. Consult Emerson, ‹Leominster, Massachusetts› (Gardner, Mass., 1888).

LEÖN, lā-ōn', **Antonio,** Mexican soldier: b. Huajuapam, Oaxaca, 1794; d. 1847. Having abandoned the side of the royalists for that of the insurgents under Iturbide, he distinguished himself in 1821 by the capture of Tehuantepec, for which he was made lieutenant-colonel. When, however, Iturbide proclaimed himself emperor, the support of Leon was given to General Bravo, the Republican leader. In 1824, as deputy from Oajaca, he served in the Constituent Congress, and later he aided in quelling insurrection against the authority of the republic. He was killed at the battle of Molina del Rey in the war with the United States.

LEÖN, Fray Luis Ponce de, Spanish mystic poet: b. Belmonte de Cuenca, 1527; d. Madrigal, 23 Aug. 1591. On graduating from the University of Salamanca he entered the Augustinian order, where his talents soon brought him prominently to the front. In 1561 he was appointed to the chair of Thomistic philosophy, and 10 years later he was also appointed professor of sacred literature. But his keen, investigating intellect got him into trouble the following year, when he was charged with expressing doubt as to the validity of the Vulgate, and also with having published unauthorized versions of the Bible or parts thereof. The story is that he had rendered into Spanish the ‹Song of Songs› (of Solomon) for a friend, and that this was published without his knowledge or consent. However, the affair cost him over four years' imprisonment. During this period much of his best literary work was done. On his release from prison in 1576, with a warning to be more careful in the future, his chair in the university was restored to him and he was assigned the subject of Biblical exegesis. But, owing to his brilliancy, his reputation as a poet, mystic and theologician, he had numerous enemies who watched him closely and some of them made other charges against him in 1582. These, however, were not sustained, thanks probably to his growing power in the order to which he rose to be vicar-general shortly afterward. This seems to have silenced his enemies, and he was raised to the high dignity of provincial of Castile; but he lived only 10 days afterward. Among his prose works are ‹Los Nombres de Cristo,› consisting of three books, the result of his literary activity during his four years' imprisonment; ‹La Perfecta Casada›; ‹Exposición del Libro de Job›; ‹Song of Solomon and Commentary.› These were long popular. His mystical treatment of the various names given to Christ in the scriptures appealed strongly to the mystical-loving age in which he lived. In fact to all of his works belongs that mysticism that distinguished his poetical efforts. But popular though his prose was in his own day, it was as a mystic and lyrical poet that he distinguished himself above the writers of his age. His poetry is sympathetic and pleasing, scholarly and marked with a lyrical ring unsurpassed by any Spanish poetry of his century. He was widely read in the classics and his poetical works include translations from many of the Latin poets, among them Horace and Virgil. He also made translations from the Greek poets. In nearly all of these translations he has caught the spirit of the original. He successfully imitated Petrarch. León's countrymen are accustomed to divide his original poetry into four distinct classes and to accord him a very high place in each of these classes which are religious, moral, philosophical and patriotic. The moral and philosophical however are often classed under one head. So highly was his work admired that he has been proclaimed, by his admirers, the greatest poetical genius of Spain. León himself rather underestimated his own rare poetical gifts, and he used them, as he himself has explained, for the greater glory of God, and not to feed his own personal vanity. There is a fervor and sincerity about his religious poetry that bear out his confession. No Spanish author has approached him in the purity of thought and language of his sacred poems. Many of them read like the inspirations that he himself seems to have believed them to be. There is a sweetness about them united with a wondrous beauty of expression and brilliant, ever-pleasing imagery, that makes their simplicity stand for the breathing of the breath of life. His subjective mysticism is more engaging, more beautifully expressed and more truly poetical than that of any other Spanish writer in an age of mysticism. As was quite natural, he exercised a strong and far-reaching influence on the development of Spanish language in literature. He confirmed the love of the Classics and the ancient literature in Spain, and he has, therefore, been rightly looked upon as the greatest of the Spanish Classical poets. León's poems, which were not published during his lifetime, were issued by Quevedo in 1631, 40 years after his death. Merino published his collected works in six volumes in Madrid in 1816. This is still the best edition.

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LEÓN, Juan Vásquez de, Spanish conquistador and companion of Cortés during his first venture in the land of the Aztecs. He was one of the half a dozen or more companions of the conqueror who were of noble blood; and León, who was a near relative of the governor of Cuba, Velásquez, was probably the most highly connected of all the party, having a legal right to use the title «hidalgo.» He aided Amador de Lares (q.v.) in enabling Cortés to make his preparations to leave Cuba; and he was among the small band of cavalry with which Cortés invaded the uplands of Mexico. He was somewhat proud, valiant, resourceful and an excellent leader, and for this reason was trusted by Cortés who gave him high command in his forces and invariably depended upon him when something dangerous and difficult had to be done. When Cortés marched from the City of Mexico in 1519 to Vera Cruz, Léon, who did not approve of his action, tried to raise trouble; and he and his companions were promptly arrested by Cortés and confined aboard ship. León soon repented of his action and was admitted once more into the confidence of his leader. From that time on he was ever among the most faithful followers of Cortés, who considered him the most level-headed of his officers. He was frequently found making a protest against bigotry in an age when practically every Spaniard was a bigot; and he strongly objected to the useless massacres of the natives of Mexico. He was one of the guard of five men selected by Cortés to effect the arrest of Montezuma II, emperor of the Aztecs, and it was by his precipitate action that the arrest was made good at that time. He was also the commander of the body of troops that maintained the guard of the royal prisoner from the vantage point of the ante-chamber of his old palace where he was under arrest. He was a good companion and had the courtly manner of the Spanish court, and for this reason Montezuma took a great liking to him. León seems to have had more respect for the Aztec emperor than had any of his companions, and he did his best to entertain him during his captivity. León was sent by Cortés to plant a colony on the Coatzacolcos River on the Isthmus of Tehuantepec, but the latter was forced to recall him before he had time to finish his commission, owing to trouble in his own affairs; and León, obeying the call, joined him at Cholula and was with Cortés in his famous capture, at Vera-Cruz, of the forces of Narvaez, who had been sent from Cuba by Velásquez, the governor, to replace him. At this eventful time León was sent by Cortés, with an armed force, to secure the province of Pánuco. On his return to Mexico City he modified the anger of Cortés against the imprisoned Aztec emperor Montezuma, who was not able to force his people to supply the Spaniards with provisions. Shortly after this the Spaniards were forced to leave the capital of the Aztecs, and they attempted to do it secretly at the dead of a moonless night. But they were discovered, and a desperate battle ensued which resulted disastrously for the Spaniards, the greater part of whom were killed or severely wounded in this retreat, which is known in Spanish history as the «Dismal Night.» León, with the famous Pedro de Alvarado, was given command of the rearguard, the most dangerous position in the retreat. The Spaniards carried along with them a bridge which had been previously made to span the openings in the causeways which served as roads for the city of the Aztecs. At the first opening this bridge stuck fast and could not be removed in the hurry of the retreat to be used at the following openings. The place where Alvarado is said to have made a famous leap, some say on his horse, others affirm with his long lance as a vaulting pole, is still pointed out to the visitor to Mexico City. At any rate the latter came out of battle safe and sound and lived to be one of the important figures in the colony of New Spain as Mexico was called, while León lost his life on the «Dismal Night.» It is said that Cortés wept when he heard of his death.

LEON, lē′ŏn, Iowa, town and county-seat of Decatur County, 87 miles by rail south of Des Moines, on the Chicago, Burlington and Quincy Railroad. It is situated in an agricultural region devoted to dairying, stock and poultry raising. Pop. 1,991.

LEON, or **LEÓN DE LOS ALDAMAS,** Mexico, state of Guanajuato, the first city in population and second in commercial importance in the state. The distance from Leon to the United States border at El Paso, Tex., is 996 miles, to Guanajuato, 34 miles and to Mexico City 258 miles by the Mexican Central Railway. The altitude of the city is 5,864 feet above sea-level. The situation, in the midst of a fertile and highly cultivated agricultural district, is most favorable to the industries to which the city is devoted. It was founded in 1576 and has always maintained a condition of even and locally satisfactory prosperity. While there are no great manufactories in the place, it is emphatically one of the most important manufacturing cities in the republic, a considerable proportion of its simple homes being given over to the making of rebosos, zerapes, leather clothing embroidered in gold and silver, saddles, harness, bridles and numerous other articles of necessity, in which labor practically all the members of the family take part. There are also numerous other and more pretentious industrial establishments, including cotton and woolen mills, but the greater part of the manufacturing is in the modest homes of the working people. Here are located the headquarters of the northern military zone of the republic. A cathedral, a public library containing over 2,000 volumes, a church library with 9,000 volumes, a number of imposing church edifices, numerous creditable business blocks, well-paved streets and several attractive parks add to the advantages of the community as a place of residence. The banking facilities are provided by branches of the National Bank and the Bank of San Luis Potosi and an agency of the Bank of Zacatecas. Pop. 57,722.

LEÓN, lā-ōn′, Nicaragua, city situated in a large and fertile plain 13 miles from the Pacific coast. It is laid out on a regular plan, in spacious streets, with intervening squares. The public buildings are considered among the finest in Central America and include a large and massive cathedral, crowned by a lofty central dome and flanked by two towers. It is also the seat of a university. Other buildings are the old episcopal palace (built 1678), surrounded by fine gardens; the new episcopal palace (1873), the churches of La Merced, Recoleccion and Calvario, remarkable for their size and fine façades, and various other churches; the Tridente College of Saint Ramon, once a flourishing establishment, with professorships of law and medicine and numerous students, but now possessed only of a nominal existence; the government house, Cuartel General or head barracks and the hospital, occupying the old convent of San Juan de Dios. The manufactures of Leon are confined chiefly to articles in dressed leather and cutlery; and the trade, owing to its inland situation, does little more than supply its local wants, but the railway between Leon and Corinto on the coast has somewhat improved it. The markets display fruits and vegetables in great variety and almost boundless profusion. Leon was founded in 1523 by Francisco Hernández on the shore of Lake Managua and was removed to its present site in 1610. It was at one time the capital of the republic and is still the largest city. Pop. about 60,000.

LEÓN, lā'ōn', Philippine Islands, pueblo of Iloilo province, Panay, about 14 miles northwest of Iloilo. Pop. about 10,000.

LEÓN, Spain, city, capital of the province, as formerly of the ancient kingdom of the same name, 82 miles by rail northwest of Valladolid. Its trade is chiefly domestic; its importance is historical, dating from a strong military station under the Romans, part of whose fortified walls are still standing. Situated on an open plain below the neighboring mountains, León has two great monuments, both of deep significance in the history of Spanish civilization. Attached to the collegiate church of San Indor el Real is the Panteón de los Reyes which preserves unharmed in their original state the burial places of the ancient kings, queen and princes. The cathedral of León, dedicated to Santa Maria de la Regla, is one of the three great Gothic churches commenced during the reign of Saint Ferdinando III and is noted for its beautiful 13th century French blazoned glass and sculpture. The 12th century convent of San Marcos restored in 1514 is also noted for its fine architecture and ornamental façade. Pop. 18,000.

LEÓN, Spain, a northwestern province, area 5,936 square miles; population 400,000; density 66.6 to the square mile; capital León (q.v.). It is part of the former kingdom of León (area 21,038 square miles; population 1,478,000) which was divided into the modern provinces of León, Palencia, Zamora, Valladolid and Salamanca. See SPAIN — HISTORY.

LEÓN, Isla de (known also as the ISLA GADITANA; the Greek GADES and Roman GADERIA), an island off the southwest coast of Spain, in the Atlantic Ocean, separated from the mainland by the Channel of San Pedro. It is about 10 miles long by 2 miles broad, has a flat, marshy surface and many sand dunes. On it are the cites of Cadiz and San Fernando, and there is connection with the mainland by means of two bridges, one of them a railroad bridge. The island was the seat of the remotest western colony of the Phœnicians, founded 1100 B.C. Pop. 60,873.

LEÓN PINELO, Antonio de, Spanish writer: b. Peru, between 1585 and 1590; d. about 1660. He held various offices of importance under the Council of the Indies and the Spanish government. As he was born of Spanish parents, in the American colony of Peru and educated, at least in part, in Spain, where his parents were highly connected, he seems to have always enjoyed the confidence of the Spanish authorities. At an early age he gave much attention to collecting documents and information bearing on the history of the New World and especially of Spain's connection with it. Not satisfied with the result of his investigations in Peru and Mexico, both of which countries then contained notable archives, he returned to Spain to search there the records and other documents relating to the Americas. It was due to these labors that he became historian to the Council of the Indies. This position he filled so well that he became known as the best chronicler of the affairs of the New World up to his time. He wrote numerous works, some of which were published during his lifetime and others of which long lay in manuscript. Among these works are 'Epitome de la Biblioteca Oriental y Occidental, Nautica y Geográfica' (Madrid 1629); 'Tratado de confirmaciones reales de encomiendas, oficios y casos en que se requieren para las Indias occidentales' (Madrid 1630); 'Recopilación de las leyes de Indias' (Madrid 1628 and 1680); 'Aparato politico de las Indias occidentales' (1653); 'El paraíso en el Nuevo Mundo' (1656); 'Consejo Real y Supremo de las Indias, su origen y Jurisdicción, y los presidentes, consejeros, fiscales y secretarios que desde su fundación ha tenido' (Madrid 1658); 'Relación de las fiestas de la Congregación de Lima y la limpia Concepción de Nuestra Señora' (Lima); 'Historia natural de las Indias occidentales' (Madrid); 'Fundación y grandezas históricas y politicas de la Ciudad de los Reyes Lima' (Madrid); 'Historia de la Villa Imperial del Potosí'; 'Poema de la Concepción Purísima de Nuestra Señora'; 'Velos antiguos y modernos en los rostros de las mujeres, sus conveniencias y daños, ilustración de la Real Pregmàtica des las Tapadas' (Madrid); 'Questión moral si el chocolate quebranta el ayuno eclesiastico: tratase de otras bedidas y confecciones que se usan en varias provincias' (Madrid); 'Oración panegírica a la presentación de Nuestra Señora' (Madrid); 'Por la pintura y esención de pagar alcavalas' (Madrid); 'Vida del ilustrisimo y reberentísimo D. Toribio Alfonso de Modrouejo arzobispo de la Ciudad de los Reyes Lima' (Madrid 1653); 'Discurso sobre la importancia, forma y disposición de la Recopilación de las leyes de Indias'; 'Acuerdos del Consejo de Indias' (Madrid 1658); 'Gobierno espiritual eclesiastico de las Indias'; 'Anales ó historia de Madrid desde el nacimiento de Christo hasta 1658.' A very considerably larger list of titles of works by León Pinelo is preserved by the 'Biblioteca Nova de Nicolas Antonio.' Consult any good history of Spanish literature.

LEONARD, lĕn'ĕrd, **Abiel,** American Protestant Episcopal bishop: b. Fayette, Mo., 26 June 1848. He was graduated at Dartmouth College in 1870 and at the General Theological Seminary, New York city, in 1873. Entering the ministry of the Protestant Episcopal Church, he served in Missouri and Kansas until 1888, when he was consecrated bishop of Salt Lake. That bishopric he continues to retain.

LEONARD, Adna Wright, American clergyman: b. Cincinnati, Ohio, 2 Nov. 1874. He is the son of the late Rev. Adna B. Leonard, who was for many years secretary of the Board of Foreign Missions of the Methodist Episcopal Church. He was graduated from New York University in 1899 and from Drew

Theological Seminary in 1901. He was a student in the American School of Archæology in Rome, 1901–02. He entered the ministry of the Methodist Episcopal Church, joining the Newark (N. J.) Conference. After a pastorate in Porto Rico and the pastorate of the American Methodist Episcopal Church in Rome he became pastor of important churches in Ohio, and finally in 1910 pastor of First Church, Seattle, Wash. The General Conference of 1916, of which he was a member, elected him bishop of the Methodist Episcopal Church. He is the author of 'The Roman Catholic Church at the Fountain Head' (1910); and 'The Shepherd King' (1911).

LEONARD, Daniel, American jurist: b. Norton, Mass., 29 May 1740; d. London, England, 27 June 1829. He was graduated from Harvard in 1760 and after studying law became a Whig member of the General Court. Disapproving of the extreme measures of the Whigs, his sympathies were with the Loyalists and his papers, signed «Massachusettensis» and published in a Boston newspaper in 1774–75, were replied to by John Adams over the signature «Novanglus.» Leonard's articles ably defended the position of the English government and they constituted the strongest statement of that position put forth in the colonies. In 1776 he went with the English army to Halifax, N. S., and was among those named in the Banishment Act of 1778, while his property was confiscated by the act of 1779. He went to England from Halifax and was subsequently for many years chief justice of the Supreme Court of Bermuda. In 1819 John Adams published the 'Novanglus and Massachusettensis' with a preface. Consult Tyler, 'Literary History of the American Revolution.'

LEONARD, H. Ward, American inventor and electrical engineer: b. Cincinnati, Ohio, 8 Feb. 1861; d. New York, 18 Feb. 1915. He was graduated from the Massachusetts Institute of Technology in 1883, and in the following year became associated with Thomas A. Edison's staff of engineers. In 1887 he became general superintendent of the Chicago Western Electric Light Company, and in 1888 he organized the firm Leonard and Izard, engaging in the installation of central stations and electric railways. The firm was bought out by the Edison Company in 1889 and Leonard was appointed manager for the company's combined interests in United States and Canada. He later founded the H. Ward Leonard Manufacturing Company at Bronxville. He patented more than 100 inventions connected with electrically-driven machinery and vehicles, among them an automatic electric-lighting system for railway trains and motor cars, and a system of motor control, which was adopted by the United States navy. His system of motor control was also used at the Paris Exposition in 1900 in operating the moving sidewalk and was one of the features of the exposition. He was awarded gold medals at the Paris (1900) and Saint Louis (1904) expositions, and also received in 1903 the John Scott Legacy medal of the Franklin Institute. He was a contributor to electrical engineering periodicals.

LEONARD, James Francis, American telegrapher: b. Kentucky, 1804; d. 1862. He was practically the earliest telegrapher to read messages by sound and for his time was the swiftest telegraph operator in the world. In the summer of 1848 he began to receive messages by sound and soon afterward received and wrote out 55 words a minute for Professor Morse, as a test of the invention. He is buried in Frankfort, Ky., where his grave is marked by a monument erected by telegraphers.

LEONARD, William Andrew, American Protestant Episcopal bishop: b. Southport, Conn., 15 July 1848. He was educated at Phillips Academy, Andover, Mass., and at Saint Stephen's College, Annandale, N. Y.; was graduated at the Berkeley Divinity School, Middletown, Conn. He was ordained deacon in May 1871, and priest in July 1873; became assistant at Holy Trinity Church, Brooklyn, N. Y., 1871; rector of the church of the Redeemer, Brooklyn, 1873; then rector of Saint John's parish, Washington, D. C., 1880; was chaplain of the 23d Regiment, N. Y. N. G. (1876–80) and is now chaplain of the Ohio Society of New York, and of the Sons of Colonial Wars, Ohio. He was consecrated bishop of Ohio, 12 Oct. 1889; is president of the Fifth Province of the American Church, and of the trustees of Kenyon College, Gambier, Ohio. His writings include 'Via Sacra, or Footprints of Christ' (1875); 'Brief History of the Christian Church' (1878); 'New York Church Club Lectures' (1893); 'Faithful Life' (1888); 'Life of Stephen Banks Leonard of Owego, N. Y.' (1909); 'Witness of the American Church to Christianity' (Bedell Lectures, 1894).

LEONARDO DA VINCI, lā-ō-när'dō dä vēn'chē. See VINCI.

LEONCAVALLO, Ruggiero, rūd-jä'rō lā-ōn-kä-väl'lō, Italian composer: b. Naples, Italy, 8 March 1858. He was educated at the Naples Conservatory of Music and for many years resided as a teacher in Paris, where he composed songs and fugitive pieces. Under the influence and encouragement of Wagner he wrote his trilogy 'Crepusculum,' a drama of Italian history, of which 'Medici' is the first part. He is best known by his operas 'I Pagliacci' (1892); 'La Bohème' (1897); 'Zaza' (1900); and 'Der Roland' (1904). Other works by him are 'Tomaso Chatterton' (1896), a popular opera; 'Serafitus-Serafita,' a symphonic poem.

LEONFORTE, lā'ōn-fôr'tā, Sicily, city in the province of Catania, 2,133 feet above sea level, about 40 miles west of Catania. It is situated in an agricultural district, producing cereals, fruit and wine, and there are exports of sulphur and salt. Pop. 19,751.

LEONHARDT, lā'on-härt, **Gerard Adolf Wilhelm,** German jurist: b. Hanover, 6 June 1815; d. there, 7 May 1880. He was educated at Göttingen and Berlin, became an advocate and in 1837 was appointed to the Hanoverian government service. He was appointed Minister of Justice in Hanover in 1865, served as chief justice of the High Court of Appeals after Hanover was annexed to Prussia, and in 1867 received a seat in the Prussian Upper House and was appointed Minister of Justice in Prussia. He was an authority on criminal law and was instrumental in introducing many reforms in Germany's criminal code. He retired in 1879. Author of ‘Kommentar über das Kriminalgesetzbuch für das Königreich Hanover’ (1846–51); ‘Die Justizgesetzebung des Königreichs Hanover’ (1859–60); ‘Zur Reform des Zivilprozesses in Deutschland’ (1865).

LEONI, lā-ō'nē, **Leone** (sometimes called IL CAVALIERE ARETINO), Italian sculptor and medallist: b. near Arezzo, or at Menaggio, about 1509; d. Milan, 22 July 1590. He first appears in Venice where he was associated with Titian and Pietro Aretino, and he met Benvenuto Cellini at Padua in competition for the medal of Bembo. He was an engraver in the mint under Pope Paul III in 1538–40, and was afterward similarly employed at Milan under Alfonso d'Avalos. Through the influence of Ferrante Gonzaga he was appointed medallist and sculptor in the household of Charles V. He executed many busts, statues and bas-reliefs of the royalties and members of the court, a notable example of his art being ‘Charles V Repressing Violence,’ now in the Musée de Prado, where many other specimens of his work are exhibited. He is represented also in the museums at Madrid, Vienna and Windsor Castle. He possessed a valuable art collection, and his house in Milan, still in existence, was famous for its sculptural decorations. He was assisted in his work by his son, Pompeo Leoni (q.v.).

LEONI, Pompeo, Italian sculptor, son of the preceding: b. probably Milan; d. Madrid, 1610. He worked with his father, who greatly influenced his style. Together they executed the famous bronze groups of Charles V and Philip II and their families in the Escorial. Most of his life was spent in Spain, and he continued in the favor of the court after the accession of Philip III. Among his other work is the monument to Don Fernando de Valdes, at Salas, Asturias; and the mausoleum of the Marquis Poza at Valencia; together with many busts and statues of the royal family and of the nobility.

LEONIDAS (lē-ŏn'ĭ-dȧs) **I,** king of Sparta: b. 480 B.C. He was a son of King Anaxandrides, and ascended the throne about 489 B.C. When Xerxes invaded Greece, the Greek Congress assigned to Leonidas the defense of the pass of Thermopylæ. His force, according to Herodotus, amounted to over 6,000 men, of whom 300 were Spartans. After the Persians had made several vain attempts to force the pass, a Greek named Ephialtes betrayed to them a mountain path, by which Hydarnes led a body of Persians to attack Leonidas in the rear. Before this manœuvre could be completed, Leonidas, dismissing most of his allies, undertook to hold the pass with a forlorn hope of 300 Spartans, 700 Thespians and 400 Thebans. Here they resisted the main body of Xerxes' army, being attacked both in front and rear. No quarter was given or taken and it was not until the entire Spartan and Thespian corps were wiped out, that the remaining small body of Thebans surrendered. Leonidas fell early in the action, and a desperate struggle afterward took place over his body, which was rescued by the Greeks, but after the surrender Xerxes ordered the head cut off and the remains crucified. The details of the gallant resistance are lost in a maze of myths, but numerous writers have paid their tribute to Leonidas and the brave band betrayed at Thermopylæ. Consult Herodotus, V, 39–41; Cicero, ‘Tusc. Disput.,’ v. I, 42–49; Grundy, ‘The Great Persian War’ (1901).

LEONIDES, or LEONIDS. See LEO.

LEONINE VERSE, a form of Latin verse, originating during the Middle Ages, consisting of hexameters and pentameters of which the final and middle syllables rhyme. They are so called from Leonius, a poet of the 12th century. An instance of Leonine verse is found in the lines by Tennyson:

> "The long light shakes across the lakes,
> And the wild cataract leaps in glory."

LEONNATUS, lā'ŏn-nạ'tuz, Macedonian general of Pella: d. Thessaly, 322 B.C. He was considered one of the ablest commanders under Alexander the Great, and accompanied him in his invasion of Persia in 334 B.C. He was kept in positions close to the emperor's person and at Malli he and Peucestas saved the life of Alexander. He received the satrapy of the Hellespontine Phrygia after the death of Alexander, but soon afterward was killed in battle against the Athenians and their allies, who were besieging Antipater at Lamia.

LEONTIUS OF BYZANTIUM, lē-ŏn'-shĭ-ŭz ov bĭ-zăn'shĭ-ŭm (called also SCHOLASTICUS and HIEROSOLYMITANUS), Byzantine ecclesiastic: flourished in the 6th century. Little is known of his life. He mentions having in early years belonged to a Nestorian community, and he is reputed to have introduced Aristotelian definitions into theology. There is much confusion concerning the authorship of various manuscripts bearing the name «Leontius» with different surnames, but he is generally credited with being author of the polemical treatises ‘Contra Nestorianos et Eutychianos’; ‘Contra Monophysitas’; ‘Contra Severum’; and ‘De Sectis.’ His collected works are published in J. P. Migne's ‘Patrologia Græca’ (Vol. LXXXVI).

LEONTODON. See HAWKBIT.

LEONZIO PILATO, lā-ŏn'tsē-ō pē-lä'tō, or **LEO PILATUS,** Greek or Calabrian pseudo-scholar: d. at sea, on the Adriatic, about 1366. It is supposed that he met Petrarch in Padua and Boccaccio at Milan, and upon the invitation of Boccaccio to become his guest he went to Florence where the influence of his patron secured him the chair of Greek in the university. His knowledge of Greek was in no way scholarly and he was practically a barbarian. He made the first modern translation of Homer into Latin under the immediate care of Boccaccio and with more distant counsel from Petrarch. The ignorance of the Calabrian, cloaked in an assumption of knowledge and defended by a surly indifference, led Boccaccio into many errors in his own work. Pilatus appeared to have accompanied Boccaccio on his visit to Petrarch at Venice in 1363, and later went to Constantinople. On his return journey to Italy he was killed by lightning at sea. Consult Hodius, ‘De Græcis illustribus’; Petrarch, ‘Epistolæ’ (Vols. V, VI); Hutton, ‘Boccaccio’ (1909).

LEOPARD, or PANTHER, one of the great cats widely distributed over Africa and Asia, and prehistorically prevalent in southern

Europe. The general color is yellowish fawn, which becomes white on the under aspect of the body, marked with black spots of various sizes, irregularly dispersed; these spots are often rosette-like, but do not enclose a central spot as is the case with its American analogue, the jaguar (q.v.). Black examples often occur. In general appearance and conformation the leopard is tiger-like, but is considerably the inferior of the tiger in size and weight, measuring on the average about 3 feet and 10 inches from the nose to the root of the tail, which is almost as long as the body. This beautiful cat is, however, the peer of the tiger, making up in agility, quickness and wit for his lack of weight and power. Its prey consists of any animal it is able to pounce upon or overcome, and among the native villages and herdsmen of both India and Africa it is dreaded as a destroyer of cattle and sheep, since, like the American puma, when it invades a cattle-pen or sheepfold it kills many times more animals that it can eat or carry away. Nevertheless, leopards have always been among the partly tamed and trained animals of shows, and they thrive well and breed in captivity.

The leopard — which is more commonly called «panther» in India — frequents mainly wooded and rocky regions, where it can take refuge in trees, or seek among their limbs the birds, monkeys and other arboreal creatures that form a fair share of its food. It does not hesitate to attack large prey, but can rarely overcome a buffalo or one of the larger African antelopes unless the animal is taken at a great disadvantage. Not more than one pair is usually found in a given district; and they make their lair in some rocky jungle, where once a year two to four kittens are born to them, which remain with their mother until they are well grown. One hears less of man-eating leopards than of lions and tigers with the habit of attacking human beings; but the leopard is more widespread, numerous and subtle than either of the others and doubtless is the real perpetrator of many homicides attributed to the larger cats. At any rate the leopard is regarded by those familiar with him as quite as formidable a beast to encounter, and sportsmen adopt the same methods and use the same precautions as when they are pursuing the tiger. A most excellent summary of leopard-hunting experiences may be read in Porter's 'Wild Beasts' (New York 1894). For the leopard in India consult Sanderson, 'Thirteen Years among Wild Beasts in India' (1893); Forsyth, 'Highlands of Central India' (1889); Hornaday, 'Two Years in the Jungle,' and similar writers. The Persian leopard is described at length in Blanford's 'Zoology of Persia' (1876); and the 'African' by Baker, 'Wild Beasts and their Ways' (1890); Drummond, 'Large Game and Natural History of South-east Africa' (1875); Ingersoll, 'Life of Mammals' (1906); Roosevelt and Heller, 'Life Histories of African Game Animals' (1914); and many other sportsmen-travelers in that continent. See CHEETA; SNOW-LEOPARD.

LEOPARD, The. See CHESAPEAKE AND LEOPARD AFFAIR.

LEOPARD-CAT, a highly variable, tawny, much-spotted cat about two feet long in body, and with a long tail, which dwells in northern India but is not well known. It is called *Felis bengalensis* by Elliot and also by Mivart, but its identity is doubtful. Consult Lydekker, 'Game Animals of India' (1907).

LEOPARD-FLOWER. See BLACKBERRY LILY.

LEOPARD-FROG. See FROG.

LEOPARD-MOTH, a large European tussock-moth (*Zeuzera pyrina*), white spotted with black, whose caterpillars bore into the limbs of forest and shade trees, and so weaken them that they die or are easily broken by the wind. This moth has been introduced to America in the neighborhood of New York where it is one of the pests in the parks.

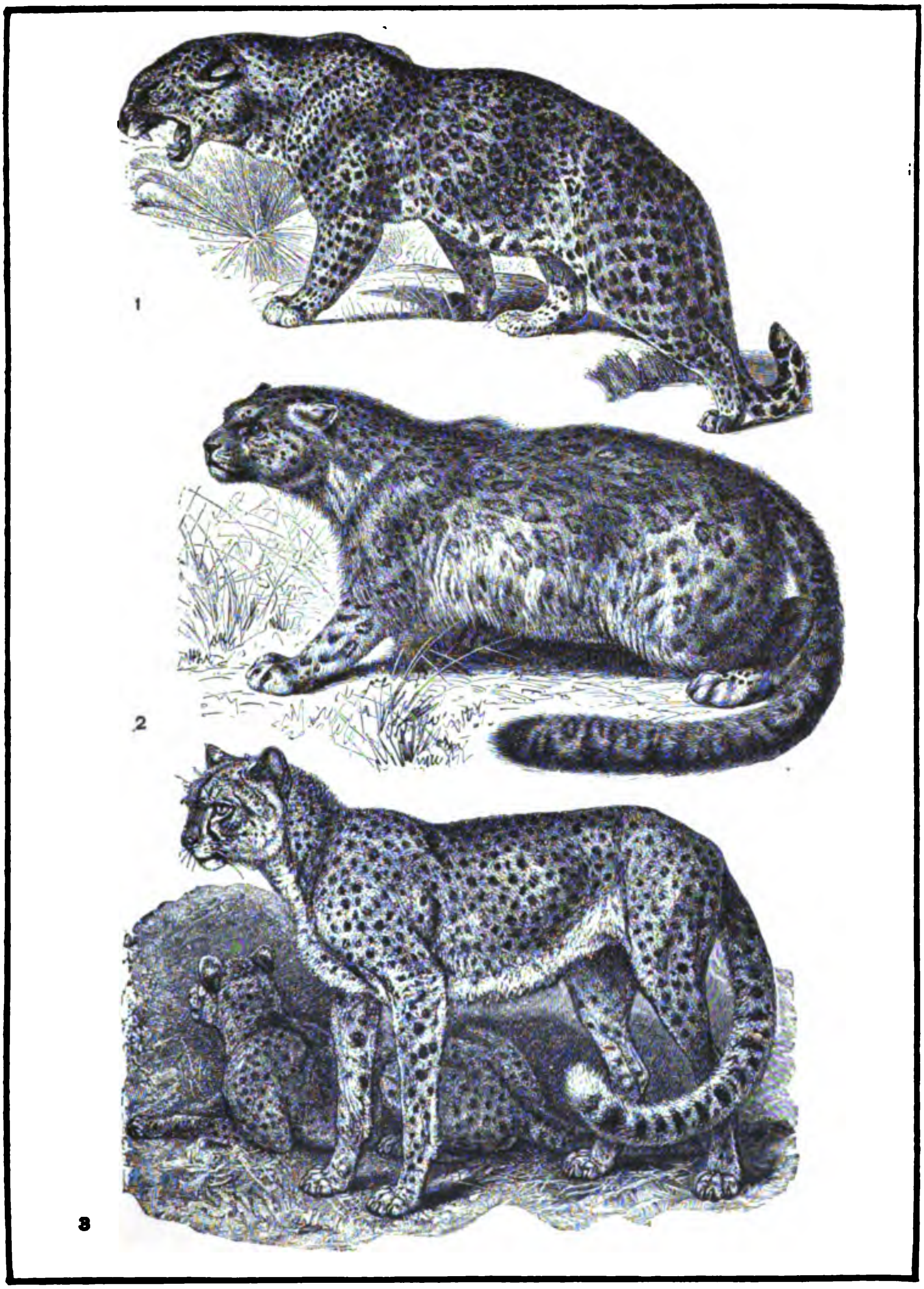
LEOPARD (lĕp'ărd) **SEAL** (SEA LEOPARD), a spotted Patagonian seal, *Ogmorhinus* or *Hydrurga leptonyx* of the family *Phocidæ*. It is widely distributed in southern, temperate and Antarctic seas. The males sometimes attain a length of 12 feet. The fur is short and lustrous, spotted yellowish white and dark gray on the back, and yellowish beneath. The fur of the females is somewhat darker than that of the males.

LEOPARD-SHARK, a handsomely variegated small shark (*Triakis semifasciatum*), often seen along the coast of southern California.

LEOPARDI, lā'ō-pär'dē, **Alessandro,** Italian sculptor: b. Venice, last half of 15th century; d. there, about 1512. His earliest known work is the magnificent mausoleum of the Doge Andrea Vendramini in the church of San Giovanni e Paolo at Venice. Some of the figures are missing, two of which authorities agree are in the museum at Berlin. He was charged with forgery and banished from Venice in 1487, but the necessity for finishing the statue of Bartolomeo Colleoni, begun by Verrocchio, caused the Senate to recall Leopardi in 1490. The pedestal of this work is his own creation and he cast the bronze statue. The bronze sockets for the three standards in the square of Saint Mark's were designed and cast by him, and he worked on the tomb of Cardinal Zeno at Saint Mark's in 1503–05, the tomb being finished by Pietro Lombardo. Among the works believed to be his but not fully verified are 'Elijah in the Fiery Chariot' in the Morgan collection, New York, a bronze relief; and the three bronze reliefs of the 'Assumption of the Virgin' in the Museo-Archeologico, Venice.

LEOPARDI, Giacomo, COUNT, **Italian** scholar and poet: b. Recanati, in the marshes of Ancona, 29 June 1798; d. Naples, 15 June 1837. He devoted himself from an early age to study in the fine library of his father, and when he reached his 15th year was master of Latin and Greek, and had soon read most of the literary masterpieces of antiquity. In 1815 his translation of Porphyry's 'Life of Plotinus' was followed by his 'Saggio sopra gli Errori degli Antichi.' He was of profound poetic genius and mourned over the degraded political condition of his native land, a feeling which found utterance in his magnificent 'Ode to Italy,' a poem which proclaimed him the first of modern Italian singers. In 1822 he went to Rome and attracted the attention of Niebuhr by his criticism of a new edition of the 'Chronicon of Eusebius'; and the great historian at-

LEOPARDS



1 The Leopard or Panther **2 Snow Leopard or Ounce** **3 Hunting Leopard or Cheetah**

tempted in vain to settle him as professor in the University of Berlin. Leopardi was broken in health, as well as in spirit, and his unhappiness was intensified by an unhappy love affair. Bunsen offered him such a professorship, and it was declined. He left Rome to travel in Italy, his tour embracing many of the great northern cities, and ending with Naples. He developed the most absolute skepticism, and the unhappiness of his lot made him a pessimist. His sight failed, and he was forbidden to take up a book, and though he was a linguist of rare accomplishments, wrote in Greek and Latin with equal ease, had mastered French, Spanish and English, he could apply his attainments to no practical end. His classic training had, however, given him a power and precision in the use of his native tongue, which was unprecedented in his day. His early lyrics were written between 1816 and 1824, and are distinguished for lucidity, genuine feeling and brilliant command of metre and rhyme. His most famous poem, however, is 'La Ginestra' (1836), in which he gives full expression to his hopeless creed; and of his poetic productions some 39 remain to this day the finest and most imperishable utterances of the Italian lyre. His other works include translations and critical treatises, and after his death were published his prose works, a miscellany of peculiar interest. His 'Epistolario,' a collection of his letters, records in the most intimate manner his personal life. Consult Autard, 'Essay sur les Idees philosophiques et l'inspiration poetique de Giacomo Leopardi' (1877); Ranieri, 'Sette anni di sodalizio con Giacomo Leopardi' (1880); Cappelletti, 'Bibliographia Leopardiana' (1882); Ceaseo, 'Nuove ricerche su Giacomo Leopardi' (1893), and 'La Vita di Giacomo Leopardi' (1905); Serban, 'Leopardi sentimental' (1913). See DIALOGUES; ODES.

LEOPOLD (lē'ō-pōld) **I** (GEORGE CHRISTIAN FREDERICK), king of the Belgians: b. Coburg, 16 Dec. 1790; d. 10 Dec. 1865. He was the fourth son of Francis, Duke of Saxe-Coburg, and after receiving a careful literary and scientific education and spending some years in foreign travel, he entered the Russian service, in which he rose to the rank of a general and commanded corps at the battles of Lützen, Bantzen and Leipzig. On the return of Napoleon from Elba he joined the army of the Rhine and with it entered Paris. While in England after the peace of 1815 he married (2 May 1816) Princess Charlotte, daughter of the Prince Regent and heiress to the throne, and was naturalized by act of Parliament and created Duke of Kendal. The princess died in childbed on 5 Nov. 1817. In February 1830 he was offered the crown of the new kingdom of Greece; was proclaimed; but as conditions he had specified regarding a rectification of frontier and his entire acceptability to the Greek people were not fulfilled, he renounced the sovereignty. On 4 June 1831 he was elected by a national congress king of the Belgians. Difficulties were encountered for the first eight years of his reign with the king of Holland, out of whose territory Belgium had been carved, and these were settled by the Treaty of Twenty-four Articles in 1839. In August 1832 he married Louise, eldest daughter of Louis Philippe of France (d. 1850). During the revolutionary troubles of 1848 he offered to abdicate if his rule was unacceptable to his subjects; but all classes rallied round the king. He ruled with great prudence, was one of the wisest monarchs of his time, was frequently called on to arbitrate on international disputes and was called the Nestor of Europe. His daughter, Carlotta, was the wife of Maximilian, emperor of Mexico. He was succeeded by his son, Leopold II. Consult Juste, 'Les Fondateurs de la Monarchie belge, Leopold, Ier Roi des Belges' (1868), an English translation of which appeared, entitled 'Memoirs of Leopold I' (1868); Taillandier, 'Le roi Leopold et la reine Victoria' (1878).

LEOPOLD II (LOUIS PHILIPPE MARIE VICTOR), king of the Belgians: b. Brussels, 9 April 1835; d. Brussels, 17 Dec. 1909. He was the eldest son of Leopold I, and married in 1853 Maria Henrietta, Archduchess of Austria (d. 1902), daughter of Archduke Joseph of Austria. He early manifested great interest in the opening up of central Africa, and in 1876 organized at Brussels the African International Association, the purpose of which was to utilize African discoveries for commercial purposes. He aided, and to a large extent financed, Stanley's explorations on the Kongo in 1879–82. By the Berlin Congress of 1885 the Kongo Free State was formed, its territory neutralized and its sovereignty conferred on King Leopold. In 1889 the king willed this domain to the Belgian people. Certain grave scandals in connection with its administration and the commercial exploitation of the natives — in the profits of which the king shared — were brought to light in 1903 and action taken by the British Parliament to have an inquiry into the abuses complained of. The result was that reforms were effected, and in 1908 the Kongo Free State became a Belgian colony. King Leopold was a man of notoriously immoral life. But he was an able monarch, who governed as well as reigned, and initiated many schemes for the commercial advancement of his country. During his reign its foreign commerce increased sixfold and its merchant fleet fivefold, and it began to take its place as a colonial power. His only son, Leopold, died in 1869; his second daughter, Stephanie, was married to Prince Rudolf of Austria who died mysteriously in 1889. He was succeeded by his nephew, Albert I (q.v.). Consult MacDonnell, J. de C., 'King Leopold II' (London 1905); Rappoport, A. S., 'Leopold, King of the Belgians' (New York 1910).

LEOPOLD I, Holy Roman emperor: b. Vienna, 9 June 1640; d. there, 5 May 1705. He was second son of the Emperor Ferdinand III of the house of Hapsburg and of Maria Anna of Spain, and was educated for the Church, when the death of his brothers made him heir to the throne of his father. Previous to the death of the latter in 1657, Leopold had (1655) been crowned king of Hungary, still mainly in Turkish hands; in 1656 he was elected king of Bohemia, and in 1658, in spite of the opposition of Cardinal Mazarin, emperor. The war with the Turks having been renewed in 1660, Montecuculi won the battle of Saint Gothard on the Raab (1 Aug. 1664), which was followed, however, by a peace which the Hungarian partisans of the emperor regarded as ignominious. In

1678 occurred the great insurrection under Tököly, due to the emperor's persecution of the Hungarian Protestants, who in 1683 obtained the help of the Turks by their invasion of Austria under Kara Mustapha. Leopold fled from Vienna, but John Sobieski's great victory saved his capital and thrones. Buda was retaken after a memorable siege in 1686, and the victories at Zalánkemén (1691) and Zenta (1697), won by the military genius of Prince Eugene, led to the peace of Carlovitz (1699), which also secured the possession of Transylvania. But neither the wholesale executions of Hungarian patriots at Eperies, nor the acquiescence of the Diet of Presburg in the proposition to make the male line of the Hapsburgs hereditary in Hungary (1687), could make peace permanent in that long-distracted country. Leopold also had to wage three protracted wars against Louis XIV; the last, the War of the Spanish Succession, which he did not live to see concluded. In the German Empire the long reign of Leopold witnessed the growing power of the house of Brandenburg, under Frederick William, the great elector, whose son assumed the royal title under the name of Frederick I in 1701.

LEOPOLD II, Holy Roman emperor: b. Vienna, 5 May 1747; d. there, 1 March 1792. He was the 3d son of the Emperor Francis I, and succeeded him in 1765 on the throne of Tuscany, where he effected reforms in the land laws and confined ecclesiastical jurisdiction to purely ecclesiastical matters. The death of his brother Joseph II in 1790 called him to the greater cares of the vast Austrian dominions and soon after of the German Empire. He hastened to make terms with Frederick William II at Reichenbach (27 July 1790), was unanimously elected German emperor, pacified Hungary by taking the royal oath to observe strictly the constitution and by various concessions, proclaimed a full amnesty and restored all their ancient privileges to the Belgians, gave Tuscany to his son Ferdinand, concluded a peace with Turkey at Sistova (4 Aug. 1791), concerted with Frederick William, Frederick Augustus of Saxony and others, at Rilnitz, preliminary measures for meeting the aggressions of the French Revolution, and finally made a formal defensive and offensive alliance with Prussia (February 1792). Francis, his oldest son, succeeded him on the throne.

LEOPOLD, Karl Gustaf af, Swedish poet: b. Stockholm, 3 April 1756; d. there, 9 Nov. 1829. He attained distinction in Swedish letters, his first work to attract wide attention being his 'Ode on the Birth of the Prince-Royal Gustavus Adolphus' (1778). He was appointed secretary to Gustavus III in 1778 and stood high in the regard of that monarch. His odes on the martial achievements of the Swedes were among his most popular productions, and his tragedies 'Odin' (1790) and 'Virginia' (1802) were highly successful. In 1818 he was appointed Secretary of State. His 'Samlade Skrifter' were published (Vols. I–III, 1800–02; Vols. IV–VI, 1831–33).

LEOPOLD, Order of, name of two orders, one of Austria-Hungary and one of Belgium. (1) The Austrian Order of Leopold was founded by the Emperor Francis I, 7 Jan. 1808, in honor of his father, Emperor Leopold II. It is bestowed for «personal merit.» There are three classes: Grand Cross; Commanders and Chevaliers. The two first carry the title of baron and the third receive hereditary nobility. The Grand Mastership is vested in the Crown and the officers of the order are the prelate, chancellor, treasurer, registrar and herald. The decorations comprise a badge, collar and star, and the habit is of the national colors. The motto is «Integritate et Merito.» (2) The Belgian Order of Leopold is a civil and military order, founded 11 July 1832 by Leopold I. It is divided into five classes: Knights Grand Cordons; Grand Officers; Commanders; Officers and Chevaliers. The Grand Mastership is vested in the Crown and the three inferior grades carry pensions. The decorations consist of a badge, a collar and a star. The motto is «L'union fait la force.» Consult Laurence-Archer, J. H., 'The Orders of Chivalry' (1887).

LEOPOLD II, Lake, a lake in the administrative district of that name in the Belgian Kongo, West Africa. It is 90 miles long from north to south and varies in width from 2 to 30 miles. Its banks are low and subject to inundation. It empties into the Mfini, an affluent of the Kwa or Kassai, which flows into the Kongo. It was discovered by Stanley in 1881.

LEOPOLDVILLE, Belgian Kongo, West Africa, a station on the left bank of the Kongo near the Stanley Pool, 235 miles in a direct line northeast of the mouth of the Kongo, connected by rail with Matadi. It is the western terminus of navigation on the upper Kongo. It was founded by Stanley, February 1882, and the native population largely preponderates over that of the whites. There is a pipe line for the conveyance of crude oil from Matadi and there is a wireless station. Pop. about 15,000.

LEPANTO, Battle of, a famous naval engagement fought near the town of Lepanto in Greece, on the Gulf of Corinth, 7 Oct. 1571, between the Ottoman and the combined Mediterranean fleets of the Christian allies, principally Venetian and Spanish craft. Under the command of Don John of Austria they obtained an overwhelming victory. Cervantes (q.v.), the author of 'Don Quixote,' distinguished himself in this battle, receiving three wounds. This was the concluding battle of the Crusades, destroying the Turkish fleet and ending their supremacy in the Mediterranean. Considering the primitive bow-gun weapons then in use, the loss of life was remarkable, being estimated as 20,000 for the Ottomans and 8,000 Christians. The allies brought into the fight 200 galleys and 8 galeasses (large three-masters, carrying cannon), while the Turkish fleet numbered 273, but of smaller size on the average and fewer cannon. The Turks employed Christian prisoners as galley-slaves and 10,000 or more were liberated by the Christian victory. Consult Maxwell, 'Don John of Austria' (1883); Prescott, 'Reign of Philip II' (1902).

LEPANTO-BONTOC, lā-pän'tō-bōn-tōk, Philippines, a province of Luzon formed by the union of the three subprovinces of Lepanto, Bontoc and Amburayan, occupying the western central part of northern Luzon; area 1,232 square miles. The province mostly is rugged and mountainous; it is thinly settled and there are no roads, communication being by trails. The only industry of importance is copper mining. Civil government was established in May 1902. Pop. 60,000, mostly Iggorotes and Ifugaos.

LEPCHAS, lĕp'chạz, a Tibetan stock of Sikkim, India. They are a peaceful people who have suffered considerably from the incursions of more warlike neighboring tribes, and both their ancient customs and their language are falling into disuse. Their language is of Indo-Chinese origin and through the efforts of Colonel Mainwaring and others who appreciated its beauty, the knowledge of it has been preserved. The literature of the Lepchas, however, has been practically destroyed, resulting in the loss of many of their traditions. Their language possesses an extensive nomenclature in zoology and botany, and the people are well versed in beast and bird lore. They are mostly Buddhists in religion. They were once prosperous and independent but are now poor and largely of the coolie class. Consult Mainwaring, 'Grammar of the Róng (Lepcha) Language in the Darjiling and Sikkim Hills' (Calcutta 1876); Von Schlagintweit, 'Results of a Scientific Mission to India and High Asia' (London 1863); Donaldson, F., 'In Lepcha Land' (1900).

LEPELETIER DE SAINT-FARGEAU, lĕ'pẹl'tyā dĕ săṅ fär'gyō', **Louis Michel,** French politician: b. Paris, 29 May 1760; d. there, 20 Jan. 1793. He came of a prominent family and inherited great wealth. Originally a conservative he was chosen president of the Parliament of Paris in 1789 and was a deputy for the nobility in the States-General. His opinions gradually changed, however, and he became an adherent of the Revolution. On 13 July 1789 he moved to demand of the king the reinstatement of Necker. He was elected president of the Constituent Assembly 21 June 1790, and at the Convention he was a deputy from Yonne, voting for the execution of the king. The Royalists had understood him as pledged to defend the king, and a member of the king's bodyguard assassinated him the evening before the king's death. He was given a splendid funeral by the Convention and his death was commemorated in a painting by David, which, however, his daughter destroyed. Lepeletier had been deeply interested in public education and many ideas from his notes were incorporated in later plans. Consult 'Œuvres de Michel Lapeletier Saint-Fargeau,' with a biographical sketch by his brother Felix (Brussels 1826).

LEPER. See Leprosy.

LEPERDITA, le'pär-dĭtysạ, a genus of fossil ostracode crustaceans of the family *Leperditiidæ*, extending from the lower Silurian to the Carboniferous Age. The shells have oblong unequal valves with a straight dorsal edge, the right valve having an overlapping ventral edge; there is a small eye tubercle and a subcentral interior muscular imprint. The exterior is smooth and rounded. They occur in abundance in eastern United States and in Europe.

LEPIDIUM, lĕ-pĕd'yŭm, a genus of plants of the family *Cruciferæ* and the tribe Sinapeæ. They are usually known as pepperwort, peppergrass and cress and number about 65 species scattered throughout the warm regions of the earth. There are about 25 species in North America, some of them of European origin, but naturalized. They are characterized by white flowers and have dehiscent pods which are almost invariably two-seeded.

LEPIDODENDRON, a fossil plant occurring in rocks of the Carboniferous Age, supposed in some cases to have been important in the constitution of coal. They are usually identified by fossil-botanists with the living club mosses, although the fossil forms are of far greater size, attaining at times a growth of 75 to 100 feet in height. They are widely distributed over the world and are abundant in the middle and lower divisions of the productive coal measures.

LEPIDOLITE, or **LITHIA MICA,** an important member of the mica group of minerals, as it is now one of the chief sources of the lithia salts so valuable in medicine. The specific gravity is 2.8 to 2.9, the hardness 2½ to 4 and the optic axial angle 50° to 70°. Its name, derived from the Greek, lepis, a scale, alludes to its usual occurrence in fine, scaly-granular masses. It rarely occurs in distinct, monoclinic crystals. It has a pearly lustre and a gray, lilac or peach-blossom pink color. It occurs in small quantities in many parts of Europe and Asia, but by far the most important locality is in San Diego County, Cal., where it is now extensively mined. It is also found in Maine and Massachusetts and has been mined near Haddam, Conn. It is very frequently associated with pink and green gem tourmalines.

LEPIDOMELANE, a species of iron potash mica. In appearance it is black and either opaque or clear, scaly and adamantine. It crystallizes in the monoclinic system. It occurs in eastern United States and northern Europe.

LEPIDOPHYTA. See Paleobotany.

LEPIDOPTERA (Gr. *λεπίς*, scale; *πτερόν*, wing): An order of the class *Insecta*, comprising the butterflies and moths. The name was given to the order because the wings are covered with little scales, or flattened hairs. The *Lepidoptera* undergo in their development a complete metamorphosis, passing through the stages of the egg, larva and pupa, before appearing as the perfect insect, or imago.

Eggs.— The eggs of the *Lepidoptera* are minute objects, though generally large enough to be seen with the naked eye. When examined under the microscope they are found to vary greatly in form according to the species. They may be spherical, hemispherical, oval, conic, cylindrical, spindle-shaped or flattened. The eggs of the *Cochlidiidæ*, or slug-moths, are circular, or elliptical, and greatly flattened, resembling microscopic pancakes. The egg of the common cabbage-butterfly is spindle-shaped. The eggs of both butterflies and moths are generally beautifully fluted with raised lines, or ornamented with a net-work of sculpturings arranged in geometrical patterns. They are always provided with a minute opening in the shell known as the micropyle, permitting them to be fertilized. This is located at the apex in most forms, but in the case of those eggs which are flattened the micropyle is located on the side. The female deposits the eggs upon the plant on which the caterpillars feed, or in close proximity to the food which is to nourish them, in the case of those few species which do not subsist in the larval stage upon vegetable matter.

Larvæ.— When the eggs hatch the insects appear as larvæ, or caterpillars. These undergo successive molts as they increase in size, shedding their skins from time to time until they have attained the development at which the next transformation, known as pupation, occurs. The bodies of larvæ consist normally of 13 segments, or somites, of which the first is the head. The forms of the larvæ are very various, though in the main they are vermiform and cylindrical. The larvæ of butterflies are for the most part smooth, though in some genera they are curiously ornamented with lateral or dorsal projections, which may be spinous, club-shaped or filamentous. The larvæ of moths are often hairy, or spinose, and in some genera of the *Lasiocampidæ*, the *Cochlidiidæ* and the *Saturniidæ*, these spines possess stinging, or poisonous, properties. Lepidopterous larvæ possess three pairs of true feet located upon the three segments immediately following the head, and corresponding to the six thoracic feet which are found in the winged form of the insects. In addition to these true feet the bodies of these larvæ are supported by from two to eight pairs of abdominal prolegs, or false feet, which are fleshy and do not recur in the imago. The head is always more or less conspicuous in the larval stage, and is provided with eyes and mouth parts adapted to cutting and deglutition.

One of the most remarkable portions of the anatomy of lepidopterous larvæ are the two long glands located in the dorsal region, which secrete a milky fluid, which is vented through a nipple-shaped organ upon the lower lip known as the spinneret, and which upon exposure to the atmosphere is transformed into the substance known as silk.

Pupæ.— When the larva has attained maturity it is transformed into a pupa. Pupæ may be naked, or they may be enclosed in a structure of silk known as a cocoon. The pupæ of butterflies are usually attached by their anal extremities to twigs, the under side of rails or stones. The attachment is effected by means of a button of silk into which the hook-like cremaster is thrust. In some families chrysalids are in addition held in place by a girdle of silk. The larvæ of many moths undergo pupation in a cocoon which may be densely woven or very loosely constructed of a few strands of silk mingled with hairs from the body of the caterpillar, or loose particles of adherent earth or fragments of leaves. Many of the hawk-moths and almost all of the owlet-moths undergo transformation in underground cells which the caterpillars mold for themselves in the soil before changing into pupæ. The duration of the pupal stage varies in length according to the species, or the season. Many species in temperate climates pass the winter in the pupal form. Where there are two or more generations in a season the pupal period is short for the summer broods, and the fall brood hibernates in the pupal state. The pupæ of butterflies are often ornamented with silvery or golden spots, hence the name *chrysalis* has been applied to them, the word being derived from the Greek (*χς,ρυσό* gold). The pupæ of moths are generally some shade of brown or black. The pupa contains the imago and in almost all cases an examination will show in the pupa the location of the various organs of the perfect insect in a rudimentary form.

The Imago.— When the period of pupation is ended the butterfly or moth breaks through the pupal shell and emerges a four-winged, six-footed insect, known as the *imago*. The females of some species of moths are apterous, or provided with wings so poorly developed that they cannot be used in flight.

Classification.— The classification of the *Lepidoptera* has afforded opportunity for much divergence of opinion among naturalists, but the division into two great suborders, the *Rhopalocera*, or butterflies, and the *Heterocera*, or moths, is well established in usage.

The *Rhopalocera* contains six families:

I. *Nymphalidæ* («Brush-footed Butterflies»). — The front pair of legs greatly reduced in size, tarsi of the male with but one joint, of the female with five, but without claws, the pupa suspended by the cremaster. There are eight subfamilies in this group, more than 250 genera and about 5,000 species known at the present time. Among these are some of the largest and most splendidly colored butterflies, which are known, as well as some of the smallest and most obscurely colored forms. The family is represented in all parts of the globe.

II. *Erycinidæ* («Metal-marks»).— The female has the first pair of legs weakly, though perfectly developed. The coxa of the foreleg of the males is spined, and the tarsi are unjointed and without claws. There are over 60 genera and fully 1,000 species in this group. The butterflies composing it are generally small, but gaily and curiously colored. The metropolis of the family is found in the hot lands of the New World, though it is also represented in the Eastern Hemisphere.

III. *Lycænidæ* («Blues,» «Coppers» and «Hair-streaks»).— The fore legs of the male are aborted, the tarsus having but a single joint terminated by a single claw. There are over 2,000 species known. The butterflies are generally small. The upper sides of the wings are prevalently some shade of blue, bronzy green or copper, though there are some species, especially in Africa, yellow, red or white.

IV. *Pieridæ* («Whites,» «Sulphurs» and «Orange-tips»).— The six legs are well developed in both sexes and the feet have two hooks or claws at the end. There are about 1,200 species known to science. The «cabbage butterfly» and the «common sulphur» of the clover fields are fair representatives.

V. *Papilionidæ* («Swallow-tailed Butterflies»).— The six legs are well developed. The claws are simple. About 1,000 species belong to this family, among them some of the largest and most splendid tropical insects.

VI. *Hesperiidæ* («Skippers»).— The six legs are perfect. The claws are short and thick. The bodies are relatively robust. In flight the insects are very quick and powerful, hence the common name. The butterflies are generally small, though there are some quite large species.

There are about 13,000 species of butterflies which have been named and described. It is probable that when we shall have explored the entire earth the total number of existing species may be found to be 18,000.

The *Heterocera*, or moths, may be divided into about 60 families, of which 43 are represented in North America. The families which have the largest number of species in North America are the *Noctuidæ*, or «owlet-moths,» the *Geometridæ*, or «measuring-worm moths,» the *Saturniidæ*, or «wild silk-moths,» the *Arctiidæ*, or «tiger-moths,» the *Sphingidæ*, or «hawk-moths,» the *Tortricidæ*, or «leaf-rollers,» and the *Pyralidæ*. More than 7,000 species of moths are known to occur in the United States and Canada, and probably more than 100,000 species at present exist upon the globe.

The most important of all the *Lepidoptera* from a commercial standpoint is the silk-moth (*Bombyx mori*), which was introduced into Europe from China by way of India, and at an early date was brought to the New World.

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LEPIDOSIREN, the American genus of *Dipnoi* (q.v.), or lung-fishes, closely resembling the African genus *Protopterus*, but having a more eel-like form, smaller scales and the paired limbs reduced to mere filaments of no use in locomotion. The single species *Lepidosiren paradoxa* was discovered by the Austrian naturalist Natterer in the tributaries of the upper Amazon in 1837. For 50 years the species was known from only two or three museum specimens, but in 1887 was rediscovered in abundance in Paraguay by an Italian zoologist and since then has been the object of several expeditions which have made it well known. It lives in the sluggish, vegetation-choked streams and lakes of that region, the natives of which spear it in large numbers for food. Its large eggs, more than a quarter of an inch in diameter, are deposited in underground nests where they are guarded by the males, whose ventral fins become densely villous and serve as accessory respiratory organs at this time. On the approach of the dry season the muscles of the tail undergo fatty degeneration and the fish retires to a mucus-lined «cocoon» in the mud at the bottom of a burrow sealed at intervals of three or four inches by plates of mud perforated by two or three small openings. In these retreats the «lolachs,» as they are called by the Indians, remain until the rains again convert the baked earth into mud. The lepidosiren feeds on large aquatic snails, confervæ and roots.

LEPIDOSTEUS. See Gar.

LEPIDOSTROBUS (Gr. «whirling scale»), a fossil cone from the coal measures, usually found in seams or nodules of clay-ironstone, and often compressed. They consist of a central axis surrounded by imbricated scales or bracts, each containing a sporangium (spore-case). They have been found united to the tip of the branches of *Lepidodendron*, and this shows that they were the fruit of that genus.

LEPIDOTUS, a genus of fossil ganoid fishes of the family *Semionotidæ*, occurring in abundance from the Keuper to the lower Cretaceous in Europe, Siberia, India and Brazil.

LEPIDUS, Marcus Æmilius, Roman triumvir: d. Circeii, 13 b.c. He became prætor 49 b.c., consul with Julius Cæsar in 46, and in 44 was appointed by Cæsar to the government of Narbonese Gaul and Nearer Spain. He came of a distinguished patrician family, and possessed great wealth and influence, but seems to have held little power, and to have been a poor commander. He was in Rome at the time of Cæsar's death, and joined Mark Antony. In 43 he united with Antony and Octavianus to form the triumvirate, obtaining Spain and Narbonese Gaul in the division of the empire. After the battle of Philippi (42) a redivision took place, in which Lepidus received Africa, where he remained till 36, when he was summoned by Augustus to assist him against Sextus Pompey. He then tried to seize Sicily, but was overcome by Augustus, who deprived him of his triumvirate, and banished him to Circeii, where he lived under strict surveillance.

LEPORIDÆ, a family of rodents comprising the rabbits and hares. With the *Lagomyidæ* it constitutes the suborder *Duplicidentata*, distinguished from all other rodents by having two pairs of upper incisors, of which the second is much reduced in size and placed immediately behind the first and larger pair. The hind-legs are much longer than the fore-legs and are well adapted by their structure for the leaping mode of locomotion affected by these animals; the tibia and fibula are completely ankylosed and articulate with the calcaneum by a pulley-like surface, thus combining great strength with great freedom of movement in one plane. The family is now cosmopolitan, some 75 species and sub-species being recognized in North America. The genus *Lepus* is practically coextensive with the family. See Hare.

LEPRA, *in botany*, a plant disease characterized by the exudation upon the surface of the leaves of a white mealy or scaly substance. In *pathology:* (1) Same as leprosy (q.v.). (2) Formerly applied as descriptive of a scaly affection of the skin now classified as psoriasis, and also known as *lephra alphos* and *lephra Græcorum*.

LEPRECHAUN, lĕp'rē'kăn, **LEPRECAWN, LUPRACHAUN,** or **CLURICAUNE,** in Irish folklore a pygmy sprite supposed to make shoes, grind meal and assist in other ways humans who are kind to him. He is supposed to reach to a man's knee in height and when not engaged in other helpful deeds is believed to be making shoes, the sound of his hammering being one of the principal means of discovering him. He is reputed to possess the secret of wealth and to be powerless to conceal it under the steady gaze of the human eye, but if the gaze be relaxed even momentarily he escapes. In some versions he possesses a purse which «always has a shilling in it» regardless of how often a shilling is spent. The word is used in Ireland in describing a dwarfed person, as «leprechaun-looking.»

LEPROHON, lĕ-prŏn', **Rosanna Eleanor Mullins,** Canadian poet and novelist: b. Montreal, 1832; d. there, 20 Sept. 1879. She was educated at the Convent of Notre Dame, Montreal, and began her literary career at 14 with contributions to the Montreal *Literary Garland.* She married Jean Lukin Leprohon, a Canadian physician, in 1851. From 1860 she was connected with the Montreal *Family Herald* and she also wrote for the Boston *Pilot.* Many of her novels were serialized and several were translated into French. Most of her novels deal with social happenings about the time of the English occupation. Her novels include ‹Eveleen O'Donnell› (1859); ‹Antoinette de Mirecourt› (1864); ‹Armand Durand› (1868). Her collected poems were published after her death (Montreal 1881).

LEPROSY, a term very vaguely used by medical and other writers to denote a disease, *Lepra tuberculosa,* which appears to have prevailed from the earliest time down to the present. The *bacillus lepræ* was discovered by Hansen in 1868. The most prominent symptoms of the disease are as follows: a constant but intermittent fever, dusky red or livid tubercles of various sizes on the face, ears and extremities; thickened state of the skin with diminution of its sensibility; falling off of the hair, except that of the scalp; hoarse, nasal or lost voice; ozæna; ulcerations of the surface, a periodical exaggeration of perspiration, connected with nervous disturbances, and a feeling of anxiety with sense of impending disaster and extreme fetor. The tubercles vary in size from that of a pea to an olive. Hands, feet and face are generally first affected.

In modern times three main forms of leprosy are recognized. In the first the whole body becomes white and scaly, without much interference with the general health. This is the type of the Biblical leprosy, and it is rare nowadays. The second variety causes a loss of feeling in the hands and feet in its earlier stages, and later on in the arms and legs. It is known as anæsthetic leprosy. It is a form of neuritis (q.v.). The sufferer from this form of the disease is much troubled with dysentery, and when the disease is advanced his hands and feet are liable to slough off. The third variety of leprosy is known as the tubercular form. It is distinguished by horrible swellings of loose skin, which becomes discolored. This is the commonest modern variety of the disease and the one most repulsive.

Leprosy was recognized 1500 B.C. in India and in the Orient and in Palestine and the countries immediately east of it leprosy existed until the dispersion of the Jews in the 1st century of the Christian Era. As the power of the Roman Empire declined in the west of Europe a strong tide of emigration from the Levant set in. The plague of leprosy spread with the teaching of Christianity until no country in Europe was free from it. It is also said that the returning Crusaders spread the disease all over Europe in the 11th and 12th centuries. Between the 6th and the 15th centuries leprosy was by far the most dangerous and infectious disease of which any account has come down to us.

To be a leper was to be an outcast beyond hope of any solace but the grave. All the larger towns in Europe had a place specially set apart for its lepers. This reservation was shunned as if it were the mouth of a burning hell. A boundary line was made, beyond which no leper could venture, except at the risk of instant death. If a healthy stranger unwittingly wandered too near the leper's camp he was remorselessly thrust into it and made to share the lot of those previously afflicted. Food was furnished to these leper camps by the town authorities. The provisions intended for the use of the lepers were left on some exposed hill, selected for that purpose, during the daytime, and removed by the inmates of the camp at night. No office, no matter how exalted, served to keep a sufferer from leprosy from universal ostracism.

In the sparsely settled country districts, solitary lepers abounded. Each one wandered about by himself in the unfrequented woods and uninhabited waste places. The rigorous compulsion of the villagers compelled him to wrap himself in a sheet so that only his eyes were exposed. He must carry a bell in his hand and ring it in order to warn wayfarers of his approach. Whenever the dismal tinkling of the leper's bell was heard, the inhabitants fled in terror of their lives. The unfortunate victim supported life as best he might by roots and berries, and by the occasional offerings of charitable persons left where he could find them.

At an early period in the history of the Christian Church efforts were made to alleviate the sufferings of lepers. An order of Saint Lazarus was formed as early as 72 A.D., taking its name from Lazarus, the beggar who ate the crumbs which fell from the rich man's table. Later on, in the 12th century, a military order of Lazarus was founded by the Knights Hospitallers. When these knights were driven out of Palestine they made France and afterward Sicily their headquarters. Numerous lazarettos were established by them in the principal cities of Europe. For many years the grand master of this order was required to be a leper. In civil law the leper was treated as one dead. His property passed to his heirs, his wife was free to marry again, and on his departure for the lazaretto prayers for the dead were repeated over him, and a shovelful of earth was thrown after him to make the ceremony complete.

With the progress of civilization leprosy gradually disappeared from every part of Europe except Norway. Lazarettos gradually fell into disuse, and only the name of leper remained as a by-word to express social and moral contamination. Great Britain was one of the last countries to cut clean of leprosy. As late as the 15th century, 250 leper hospitals were in existence there. The government, as well as other European governments, has practically banished the disease, by careful surveillance. In British America the disease still lingers in New Brunswick. In the hospital for lepers at Tracadie there have been a score of cases regularly for many years.

In the United States leprosy has existed since the Revolution and probably will continue to exist. Leprosy hospitals in secluded spots are maintained in San Francisco, New Orleans, Boston and New York, and cases are always found here in numbers from two or three to a score. In the Philippines at the time of the American occupation there were 15,000 cases in the islands, but by the census of 1902 only about 5,000 cases were reported. The disease was brought to Manila originally from Japan about 200 years ago. The number of lepers in the world is estimated to be about 3,000,000, two-thirds of which are in China.

The most celebrated leper colony or settlement in the world is that on the island of Molokai in Hawaii; but the conditions there have been much exaggerated. Molokai lies about 25 miles from the island of Oahu, and about 56 miles from Honolulu. The leper settlement on the elevated, grassy plain of Kalaupapa has an area of 8,000 acres.

The whole number of lepers at the Molokai settlement in 1902 was officially reported at 1,191, viz., 741 males and 450 females. There would be, therefore, nearly seven acres of productive soil for every member of the settlement. There are hospitals, dispensaries, churches and comfortable cottages for the accommodation of families; these cottages are well ventilated, abundantly supplied with fresh water and kept in good condition. Cottage residents requiring medical treatment are attended at their own homes by the resident physician. Every man, woman and child may draw 21 pounds of fresh beef every week, a liberal supply of taro, flour or bread, rice, tea, sugar, salt, tobacco and matches, and as much good clothing as required. A sum of money is paid to those who do not draw the full ration, which enables them to purchase articles not included in the regular supply.

It is reasonably certain that leprosy can be cured by competent skin and nerve specialists. See «Neuritis» in Jelliffe and White, 'Diseases of the Nervous System' (1917).

LEPSIUS, lĕp'sē-oos, **Karl Richard**, German Egyptologist: b. Naumburg, 23 Dec. 1810; d. Berlin, 10 July 1884. After studying philology at Leipzig, Göttingen and Berlin, he published his first work, 'Le Tabulis Eugubinis' (1833) and therupon removed to Paris. In 1835 he visited Italy and took up his residence at Rome. He subsequently went to London and projected with Bunsen a large work on ancient Egypt. He started in 1842 and spent three years exploring in Egypt from the Sudan north of Khartum to the coast of Syria, obtaining an enormous amount of data. His life henceforth was that of an ardent Egyptologist, and honors were showered upon him. He was professor in the Berlin University, director of the Egyptian section of the Royal Museum, director of the Royal Institute, head of the Royal Library, etc. In 1866 another trip to Egypt resulted in his famed discovery of the Decree of Tawis, or Table of Canopus. He was author of a large number of important works on Egyptian antiquities, one being the 'Nubische Grammatik' which is perhaps the least contribution to modern knowledge of the Nubian language. His 'Chronologie der Agypter' is also a standard authority.

LEPTOCARDII. See ICHTHYOLOGY.

LEPUS («the hare»), in astronomy, one of the 48 constellations south of Orion, containing several bright stars, among them Alpha and Beta Leporis.

LERAY, lĕ-rā', **Francis Xavier**, American Roman Catholic bishop: b. Châteaugiron, France, 1825; d. France, 1887. He was educated at Rennes, but in 1843 crossed the Atlantic and settled at Baltimore. He went through the ordinary theological course under the direction of the Sulpicians and was admitted to the priesthood 1852. He was a chaplain in the Confederate service during the war and afterward returned to Vicksburg, and while the plague of 1867 raged was always at hand to comfort and assist the sufferers. In 1873 he was consecrated to the see of Natchitoches, La., and 10 years later promoted to the archbishop's chair of New Orleans.

LERDO DE TEJADA, Sebastian, sā-bäs'tē-än lär'dō dā tā-hä'dā, Mexican statesman: b. Jalapa, Mexico, 25 April 1825; d. New York, 21 April 1889. He was educated at the College of San Ildefonso, Mexico, was admitted to the bar in 1851 and was appointed a judge of the Supreme Court in June 1857. He was Minister of Foreign Affairs in 1857; member of Congress in 1861–62 and in 1862–63; and accompanied President Juarez in 1863–67, during which time he was successively Minister of Justice and Minister of Foreign Affairs. He was elected chief justice of the Supreme Court in December 1867, and on the death of Juarez, 18 July 1872, succeeded to the Presidency, and in the following November was elected to that post. In 1876 he was again candidate to succeed himself, and after a doubtful election was declared re-elected by Congress. This action resulted in a revolution headed by Diaz, and Lerdo's adherents were signally defeated at Tecoac, 16 Nov. 1876, while Lerdo was forced to leave the country. He lived in retirement in New York City till his death.

LÉRIDA, lā're-dạ, Spain, city, capital of the province of the same name on the river Segre, an affluent of the Ebro, 82 miles by rail northwest of Barcelona. It consists of an upper and a lower town, distinctive features of which are the two cathedrals. The 13th century cathedral exhibiting Byzantine, Moorish and Gothic architecture, perched on the hill, is surrounded by fortifications and serves as a military storehouse. It is a beautiful church, full of fine ornamental sculpture and the «Porta dels Fillols» is an excellent example of a remarkable Catalan type. In the new cathedral of Corinthian style in the lower town there is a magnificent cope of 13th century Moorish silk. There are also noteworthy Romanesque houses, old convents, a former palace of the kings of Aragon, the episcopal palace, schools and educational institutions. The streets are narrow and gloomy. Cotton, woolen, silk, leather and glass goods are manufactured. As Ilerda, an aboriginal settlement, it is noted for its resistance to the Roman invaders. Its episcopal see dates from the Visigoth occupation, and in 546 a council assembled here. Pop. 24,500.

LERIDA, Spain, a northeastern province of ancient Catalonia; area, 4,690 square miles; pop. 291,850; density. 60.4 to the square mile. Capital Lérida (q.v.).

LÉRMONTOF, Mikháïl Yúryevitch, Russian poet and novelist: b. Moscow, 1814; d. 15 July 1841. He was descendant of a Scotchman, named Learmont, who emigrated to Russia. The Lérmontof family were small landowners in the government of Tula. His mother died at the early age of 21 when he was only two-and-a-half years old and his father, of whom nothing is known beyond the fact that he was an army officer, confided the child to the care of his grandmother, an aristocratic lady who owned the village of Tarkhanui not far from the town of Penza. She did everything in her power for his education so that he might take a high position in the world of fashion.

When he was in his 13th year he was put into a boarding school for boys of noble birth, in Moscow, to prepare for the university and there spent five years, recognized even then for his brilliant mind and attractive qualities. He was admitted into the university but was soon involved apparently without direct fault in a trivial escapade which the stern discipline then in vogue punished by expulsion. As this cut him off from his chosen career, he went to Saint Petersburg and in March 1832 enrolled himself in the Yunker School where he remained two years. During this time he devoted himself assiduously to poetical composition and produced his 'Ulansha,' 'Mongo' (in which he described himself under the name of «Myoshka»), and 'Peterhofsky Prazdnik' ('A Festival at Peterhof') as well as several Caucasus poems, such as Izmaïl-Bey and Hadji-Abrek. In these he showed a tendency to be cynical and was openly an imitator of Byron, who exercised a great influence over the young writers of Russia. In 1834, shortly after he had left the Yunker School, he wrote his drama 'Maskarad' and a semi-epic poem, 'Boyarin Orsha.' But his definite career as a writer began two years later, when at the cold-blooded murder of Pushkin in an enforced duel, he published a monody 'On the Death of a Poet' which created a sensation. In March of the same year Lérmontof was attached as ensign in the Nizhigorodsky Regiment of Dragoons and was sent to Georgia. Through the efforts and influence of his grandmother he was speedily recalled, however, and was transferred to a regiment of the guards. His first important work on his return was his celebrated 'Song of the Tsar Iván Vasilyévitch, The Young Life-guardsman, and the Bold Merchant Koláshinkof' which was immediately recognized as introducing a new spirit into Russian literature. In this he seems definitely to have found himself, or at least to have discovered what wealth there was in the folklore of the Russian people. No longer is there any trace of the cynical romanticism of the Byronic epoch. In its way, though not so extended a work, it was a considerable improvement on his clumsily constructed but nevertheless beautiful epic, 'Demon,' with which his name is more familiar to foreign readers, perhaps partly because portions of it were set to music by Rubinstein. 'Demon' was written between 1829 and 1834, and when published attracted at first little attention. In 1839, after a period of comparative inactivity, he brought out a series of tales which were afterward united under the title, 'Heroï Násheva Vrémeni' ('A Hero of our Time'). Its chief character, Petchórin, was meant to be a type of the Russian practising the vices of that generation, and judging from the author's descriptions in his private letters of his own mode of life, it is evident that, like Byron, he painted a portrait of himself. Petchórin, like Tchítchikof in Gogol's 'Dead Souls' and Oblómof in Gontcharóf's great novel, became a household word. In February 1840, in his capacity as a hero of his time, he fought a duel with the son of the famous French historian, De Barant, then ambassador at the Russian court, and as a punishment was transferred without loss of rank to the Tenginsky Infantry Regiment and for the third time sent to the Caucasus. On the way he wrote his famous poem, 'Tútchki nyebyésnuiya, vyétchnuiye stránniki' ('Heavenly clouds, perpetual wanderers'). The same year appeared his 'Hero' in book form and the first complete edition of his poems, most of which had been printed in Otétchestnyennuiya Zapiski («Annals of the Fatherland»). On 15 July 1841 he picked a quarrel with one of his comrades, by the name of Martuinof, and was killed. His friends buried him in a grave over which poured the bright sun of the Caucasus which he loved so well; but later his body was transferred to an arched tomb in the little village of Tarkhanui where he had spent his childhood. He was only 27 years old and, like Pushkin, in the prime of his genius. His death was an irreparable loss to Russian letters; but even during his brief life, which was one year longer than Keats' and only three years less than Shelley's, he won for himself a position not much inferior to that of Pushkin.

Nathan Haskell Dole.

LERNÆA. See Fish-lice.

LEROUX, lĕ-roo, **Frédéric Etienne,** French sculptor: b. Eccouché (Orne), 3 Aug. 1836; d. 1906. He studied with Jouffroy and at the Beaux-Arts, became an exhibitor at the Salon in 1863, obtained a medal of the second class at the Paris Exposition of 1878, and a silver medal at that of 1889. Among his best-known works are 'Demosthenes on the Shore'; 'Joan of Arc'; 'Marchand de Violettes'; 'Bouquetière.'

LEROUX, Hector, French painter: b. Verdun, 27 Dec. 1829; d. 1900. He was a pupil of the Beaux-Arts and of Picot, in 1857 obtained by his 'Lazarus' the second Prix de Rome, traveled in Greece and Asia Minor, and became known for his reposeful and dignified scenes from the ancient life of Greece and Rome. Among his works are 'A New Vestal' (1863), now in the museum of Verdun; 'Funeral in the Columbarium of the House of the Cæsars’ (1864); ‘Messalina’ (1868); ‘The Vestal Tuccia’ (1874) in the Corcoran Gallery, Washington; ‘The Burial of Themistocles’ (1876); ‘The Fall of Herculaneum’ (1881); ‘News from Outside’ (1891); ‘Hagar and Ishmael’ (1892); ‘Joan of Arc at Domremy’ (1900).

LEROUX, Louis Eugène, French painter: b. Paris, 28 Sept. 1833. He studied with Picot, became known for his genre-scenes derived from Breton life, and painted, among his more important works, ‘Le Nouveau-Né’ (in the Luxembourg Gallery); ‘Avant l'Ensevellisement’; ‘La Prière’; and ‘Avant la Confession.’

LEROUX, Robert Henri (called HUGUES), French journalist and author: b. Havre, 1860. He became a journalist at Paris where he wrote for the *Temps, Matin, Figaro, Journal* and other newspapers, and published two works on Russia, ‘La Russie Souterraine’ (1885) and ‘L'Attentat Sloughine,’ a story of the Nihilists. He has visited the United States as lecturer before the Cercle Français de l'Harvard. His further works include ‘L'Autre France’ (1900), a drama, with Decourcelle; the works of fiction, ‘Un de Nous’ (1886); ‘Le Maitre de l'Heure’ (1897); ‘Le Fils à Papa’ (1900); and the studies and sketches, ‘Au Sahara’ (1891); ‘Portraits de Cire’ (1891); ‘En Yacht’ (1892); ‘Marins et Soldats’ (1892); ‘Notes sur la Norvège’ (1894) and ‘Nos Filles: Qu'en Ferons-Nous?’ (1898).

LEROY, lĕ-roi', **William Edgar,** American naval officer: b. New York, 24 March 1818; d. there, 10 Dec. 1888. In 1832 he entered the navy as midshipman and served as a lieutenant on the *Princeton* during the Mexican War. He served in the United States navy during the Civil War also, doing good service, especially at Charleston in 1863 and Mobile Bay in 1864, became a commodore in 1870 and a rear-admiral in 1874. He commanded the South Atlantic squadron 1876–79 and retired from active service in 1884. On account of his courtly manners and general fastidiousness he was often styled «the Chesterfield of the Navy.»

LEROY-BEAULIEU, lė-rwä bō-lē-ė, **Henri Jean Baptiste Anatole,** French historical writer: b. Lisieux, Calvados, 1842; d. 16 June 1912. He was a brother of Pierre Paul Leroy-Beaulieu (q.v.). In 1881 he was appointed to the chair of modern history in the Ecole Libre des Sciences Politiques, and in 1887 was elected to the Academy of Moral and Political Sciences. He became director of the former institution in 1906. He contributed extensively to the *Revue des Deux Mondes* and published in 1882 the important work, ‘L'Empire des Tsars et les Russes,’ a study of Russian history, politics and civilization. Others of his publications are ‘La France, la Russie, et l'Europe’ (1888); ‘La Révolution et le Libéralisme’ (1890); ‘Les Congrégations religieuse et l'expansion de la France’; ‘Etudes russes et européennes’; ‘Christianisme et Socialisme’ (1905).

LEROY-BEAULIEU, Pierre Paul, French economist: b. Saumur, Maine-et-Loire, 9 Dec. 1843; d. Paris, 10 Dec. 1916. He was educated at the Lycée Bonaparte and the Ecole de Droit of Paris and the universities of Bonn and Berlin; became a journalist at Paris; wrote his ‘L'Influence d'Etat Moral et Intellectuel des Populations Ouvrières’ (1868), crowned by the Academy of Moral and Political Sciences; assisted in founding the Ecole Libre des Sciences Politiques and was appointed professor of finance there in 1872. In 1880 he became professor of political economy in the Collège de France. He established in 1873 *L'Economiste Français,* which he continued to edit. In 1878 he was elected to the Academy of Moral and Political Sciences. He came into prominence in 1912 by an arresting appeal to the French people, in which he pointed out the grave dangers of the depopulation and denationalization of France owing to the declining birthrate. Among his further writings are ‘La Colonisation chez les Peuples Modernes’ (1873); ‘Précis d'Économie Politique’ (1888); ‘Traité Théorique et Practique d'Économie Politique’ (1895); ‘La Rénovation de l'Aise, Sibérie, Chine, Japon’ (Eng. trans. 1900); ‘La Sahara, le Sudan et les chemins-de-fer transsahariens’ (1904); ‘The United States in the Twentieth Century’ (1906); ‘Le Question de Population’ (1913).

LÉRY, Jean de, zhŏṅ dė lā-rē, French Calvinist preacher: b. La Margelle, France, 1534; d. 1601. In 1556 he was sent from Geneva to preach at Rio Janeiro, Brazil, where French colonies had been established by the Huguenots, and was the first Protestant minister to preach on the American continent. He and the preachers who accompanied him were obliged to return to France owing to a bitter minunderstanding regarding their salaries. Léry has left an account of his travels in the west under the title ‘Histoire d'un Voyage fait en la Terre du Brésil’ (1578).

LES CHÂTIMENTS, lā shăt'ē-măṅ'. ‘Les Châtiments,’ one of the important poetical works of Victor Hugo, was written during his exile after the *coup d'État* of 2 Dec. 1851. A partial edition published in Brussels prompted the author to give a complete edition from the Channel Island of Jersey where he was then residing (1853). It was only in 1870, after the fall of Napoleon III, that a final edition could be publicly issued in France. ‘Les Châtiments’ is a collection of poems protesting against the political crime of Louis Napoléon Bonaparte, in which lyrical satire assumes the most varied forms, from sublime eloquence to abusive, almost coarse, personalities. This protestation of right against might, of justice against violence, gives to the author full opportunity to display the qualities which characterize his poetical works: power of imagination, suggestion and association, combined in this case with a personal feeling of indignation against what he considers as a public calamity and a step backward in the road of social and political progress. Although the book is divided into seven parts, there is no real sequence nor order in this collection of satirical poems, but this defect is more than balanced by the admirable combination of poetical forms, the variety of tones, rhythms and metres, the richness of the vocabulary, the harmony of words well suited to the expression of the thought or to the character of the subject. Hugo's fondness for antithesis in words as in composition is seen throughout the work and some of the poems consist of two symmetrically balanced parts. Probably the best known of them is ‘L'Expiation,’ in which occur the epic descriptions of Napoléon I's retreat from Russia and of the battle of Waterloo. Consult Swinburne, ‘Essay on Victor Hugo’ (London 1886); Rigal, ‘Victor Hugo, poète épique’ (Paris 1900).

L. A. Loiseaux.

LES LETTRES PERSANES. The Persian Letters (1721) of Montesquieu was a lively political satire, spiced with rather warm imaginings of life in an Oriental seraglio. Behind the transparent veil of a setting foreign to French ways, the Letters offer a keen and trenchant criticism of the whole social and political structure of France, scourging the insatiable cupidity of the courtiers, the privileged idleness of the nobility, the impudence in business of parvenu financiers. In exposing the meaner side of the decaying years of Louis XIV, Montesquieu is as pitiless as Saint-Simon. But he is constructive also. Much of the future «Spirit of the Laws» is here in embryo, and in the myth of the troglodytes he touches the origin and bases of all society. This myth tells how a people by surrender to their natural instincts brought about their own destruction and how two families, escaping the general ruin, founded a stable society on the domestic and military virtues and the sanctions of an official religion. In this aspect the Letters range themselves with such tales of Voltaire as ‘Candide’ and ‘Zadig’; in their ethical and artistic aspect the connection is closer with Prévost's ‘Manon Lescaut’ or Du Clos' ‘Liaisons dangereuses.’ The position is that of a dilettante sceptic, without ideals, with scientific curiosity, a very lukewarm interest in art and letters and a peculiar libertine precocity, a coquettish Rabelaisianism, one of the beginnings of the refined indecency that was to characterize nearly all the century. In more serious portions of the Letters the agility and variety of the thought recalls La Bruyère and foreshadows Voltaire and Beaumarchais. In the history of fiction the Letters are significant for the stimulus that they gave to the novel by correspondence soon to be made very popular by the translations of Richardson and the novels of Rousseau. There are two English versions.

Benjamin W. Wells.

LESAGE, lĕ-säzh, **Alain René,** French novelist and playwright: b. Sarzeau, near Vannes, 8 May 1668; d. Boulogne-sur-mer, 17 Nov. 1747. He studied law in Paris and became an advocate, but soon afterward turned all his attention to literature. He made many fruitless efforts after recognition and success, principally by translating from the Greek and Spanish. At length two plays of his, ‘Crispin Rival de Son Maitre’ (1707), adapted from a Spanish piece of Mendoza's, and ‘Turcaret’ (1708), a satire on the financiers of his day, had a genuine success. But he gained even greater praise and reputation from his comic romance, ‘Le Diable Boiteux’ (1707). This was indeed merely an imitation of a Spanish tale of Guevara, which he completely Gallicized so as to direct its point against the pietism which characterized the last period of Louis XIV's reign. But his greatest work was ‘Gil Blas de Santillane’ (1715–35). To his eternal disgrace Voltaire as well as many Spaniards jealous for their country's honor asserted that this novel was a bare-faced plagiarism from a Spanish original. In ‘Gil Blas’ the wit of the author is triumphant and the surprises and adventures of human life, with all the ups and downs of fortune, are made to rouse our sense of humor as well as our keenest interest, and to dazzle our fancy by the swiftness and variety of their changes. The work is, of course, destitute of high ideal and all moral aim, but it has been compared with those of Rabelais and La Fontaine, and its hero was certainly the precursor of Figaro. The most memorable of Lesage's other romances are ‘Les aventures de Guzman d'Alfarache’ (1732), an imitation of a Spanish romance of Mateo Aleman; ‘Estevanille Gonzales’ (1734); ‘Les aventures du chevalier de Beauchesne’ (1732), founded on contemporary memoirs; and ‘Le Bachelier de Salamanque’ (1736), the latter the production of his declining years, and highly valued by him. But his most numerous works were vaudeville and comic operas (101 in all). Lesage was the forerunner of the realistic school and while not a creator he was a keen observer, painting life as he found it with a keen understanding of its foibles. The Academy revenged itself on him for the graceless levity and irreverence toward the learned professions which he exhibited in his works, by refusing to elect him to their number. But they failed to check the growth of his fame. His influence was first spread in England through Smollett and in France through Balzac. Although popular in his lifetime he was little appreciated, but his place in French literature now appears more secure than ever. A full edition of his works was published in Paris in 1828. Consult Claretie, ‘Le Roman en France an début du XVIII. Siècle, Lesage Romancier’ (1890); Barbaret, ‘Lesage et le Théâtre de la Foire’ (Dijon 1887); Brunetière, F., ‘Critiques’ (Vol. III, Paris 1880); Faguet, E., ‘Dix huitième siècle’ (ib. 1885); Lintilhac, Eugène, ‘Grands écrivains français’ (ib. 1893); Saintsbury, G. E., ‘Essays on French Novelists’ (London 1891). See Gil Blas; Lame Devil, The.

LESBOS, lĕz'bŏs. See Mitylene.

LESCHETIZKY, lĕsh-ē-tĭts'kĭ, **Theodor,** Austrian pianist: b. Lancut, near Lemberg, Austria, 22 June 1830; d. 15 Nov. 1915. He received his first instruction from his father, a prominent teacher in Vienna, and after a successful concert tour in 1864 was made professor of the pianoforte at the conservatory of Saint Petersburg, where he turned out many illustrious pupils. In 1878 he returned to Vienna with an ever-increasing reputation. As a pianist he was remarkable for delicacy of touch and a magic power of expression. As a composer he published some very elaborate pieces for the piano, some songs and an opera, ‘Die erste Falte’ (1867). Among his more famous pupils are Helen Hopekirk, Mark Hambourg and Paderewski. Consult Annette Hullah, ‘Theodor Leschetizky’ (London 1906).

LESGHIANS, lĕs'gĭ-ạnz, a group of semi-savage tribes of the eastern Caucasus, inhabiting the region of Daghestan. They have been called Lehi by the Persians, Kists by their neighbors, the Georgians, while their own general name is Naktchuoi. They include the Avars, Lakions, Dargis and Chechezians. Their origin is prehistoric and their relationship to each other is not clear, but probably chiefly religious, they being mainly followers of Murad (q.v.), a Mohammedan prophet. They came under Russian dominion in 1859, when their chief Shamyl was defeated. Their men are large and powerful, though not as handsome as the Circassians, having prominent noses and a Mongolian cast. Some of the tribes are fair, however, showing Circassian mixture. They are very independent and fought 30 years against Russian supremacy. They raise goats and cattle on the slopes of the hills, operate primitive forges and manufacture coarse clothing. Consult De Morgan, ‘Recherches sur les Origines des Peuples du Caucase’ (1889); Hutchinson, ‘Living Races of Mankind’ (1901).

LESLEY, lĕs'lĭ, **J. Peter,** American geologist: b. Philadelphia, 17 Sept. 1819; d. Milton, Mass., June 1903. He was graduated at the University of Pennsylvania in 1838, for the next three years was engaged as assistant in the first geological survey of Pennsylvania. In 1844 he was graduated at the Princeton Theological Seminary and licensed as a minister. Visiting Europe, he made foot-journeys through several countries and for a while studied at the University of Halle. From 1845 to 1848 he labored for the American Tract Society among people in the mountain districts of Pennsylvania and then served two years as minister of a Congregational church at Milton, Mass., resigning on account of a change in his religious views. Returning to Philadelphia, he resumed his geological researches, extending his investigations throughout the coal, oil and iron regions of this country and Canada. In 1855 he became secretary of the American Iron Association; in 1858 secretary and librarian of the American Philosophical Society; and State geologist of Pennsylvania in 1874. He was also professor of geology at the University of Pennsylvania 1872–78 and there in 1886 was appointed emeritus professor. In 1863 he went to Europe to examine the Bessemer iron works for the Pennsylvania Railroad Company, and in 1867 was appointed by the United States Senate a commissioner to the Paris Exposition. He was president of the American Association for the Advancement of Science in 1884. He edited many works, published numerous scientific papers in various journals and reports, and also wrote ‘A Manual of Coal and Its Topography’ (1856); ‘The Iron Manufacturer's Guide’ (1858); ‘Man's Origin and Destiny from the Platform of Sciences’; ‘Historical Sketch of Geological Explorations in Pennsylvania’ (1876); and ‘Paul Dreifuss, His Holiday Abroad’ (1882). Consult Ames, M. L., ‘Life and Letters of Peter and Susan Lesley’ (2 vols., New York 1909).

LESLEY, John, Scottish prelate and historian: b. Scotland, 29 Sept. 1527; d. near Brussels, Belgium, 31 May 1596. He was educated at King's College, Aberdeen, and in 1554 became professor of canon law there. He strongly opposed Knox and everything pertaining to the Protestant movement in Scotland. A firm friend of Mary, Queen of Scots, and by her appointed bishop of Ross, he was concerned in the scheme for her marriage to the Duke of Norfolk, and in the consequent rebellion in the north of England, with the plan for Spanish intervention, and was imprisoned in the Tower. While there he wrote ‘Piæ Consolationes.’ Finally he was led to confess and as a consequence the Duke of Norfolk was executed. When released in 1573 he crossed to the Continent and in 1593, as a reward for his efforts in encouraging the populace to resist a siege in the Civil War, was created bishop of Coutances in Normandy. His chief production is a history of Scotland (1578), in 10 books, seven in Latin and the last three Scottish dialect. He was also the most active in the group of commissioners who revised the laws of Scotland and oversaw the printing of ‘Actis and Constitutionis of the Realm of Scotland’ (1566).

LESLIE, Charles Robert, American genre painter: b. London, England, 19 Oct. 1794; d. there, 5 May 1859. His parents were Americans, the father being a watchmaker of Philadelphia, and to that city they returned with the boy in 1800. There he completed his education at the University of Pennsylvania and was afterward apprenticed to a bookseller. A portrait drawn from memory of G. F. Cooke, the actor, caused a mild sensation among certain business men in Philadelphia, and by means of a subscription, headed by his employer, he was sent in 1811 to England and studied under Allston, West and others; became the intimate friend of Coleridge, Washington Irving and Constable, the artist; began to exhibit in 1813; was elected associate of the Royal Academy in 1821 and in 1826 to full membership. He first adopted a style in large historical subjects, but his genius led him into historical genre of a humorous character, in which he excelled alike in conception and execution, and in which his gentle humor was as pervasive as his finished manner. He was first brought into wide notice by his ‘Sir Roger de Coverley Going to Church’ (1819). To this period belong his portrait of Washington Irving and the illustrations which he designed for that author's ‘Sketch-Book’ and his ‘Knickerbocker's History of New York.’ Leslie's election as an associate of the Academy was secured by ‘Mayday Revels in the Time of Queen Elizabeth.’ In 1824 he visited Sir Walter Scott at Abbotsford and painted his portrait. He was elected professor of drawing at the United States Military Academy, West Point, in 1833, accepted the position, but in a few months gave it up and returned to England. In 1838, at Windsor, he painted ‘The Queen Receiving the Sacrament after the Coronation.’ From 1848 to 1852 he was professor of painting at the Royal Academy. His principal pictures illustrate scenes from the works of great authors. His draughtsmanship and composition are both good; but he was lacking in the gift of color — indeed in this respect his later work declined. His greatest qualities are his delicate perception of character, intense feeling for the domesticities, his humor which is always in good taste and the beauty and grace of his delineations of womanhood. His best-known paintings include ‘Sancho Panza in the Apartment of the Duchess’ (1824); ‘Uncle Toby and the Widow Wadman’ (1831); ‘The Dinner at Mr. Page's House’ (1831); and ‘The Taming of the

Shrew’ (1832). He published a volume of lectures as a ‘Handbook for Young Painters’ (1855); ‘The Memoirs of Constable’ (1845); an unfinished ‘Life of Reynolds’ (1865); and ‘Autobiographical Recollections’ (1860).

LESLIE, Eliza, American author: b. Philadelphia, 18 Nov. 1787; d. Gloucester, N. J., 1858. Her girlhood was spent partly in London, England, where her brother, Charles Leslie (q.v.), afterward became distinguished as an English artist. She returned to the United States in 1799 and the rest of her life was nearly all passed in her native city. She first became famous by her ‘Seventy-five Receipts for Pastry, etc.’ (1827), followed by ‘The Domestic Cookery Book’ (1837), 40,000 copies of which were sold; ‘The Home Book’ (1840); and ‘The Ladies’ Receipt Book’ (1846). She had, however, soon after the success of her first work, begun to write juvenile and other works, and for a generation was one of the most popular of American prose writers. Her books are mainly, though not invariably, written to enforce moral instruction, and among them are ‘The American Girls Book’ (1831); ‘Stories for Helen’; ‘Kitty’s Relations’; ‘Leonilla Lynmore’; ‘The Maid of Canal Street’; ‘The Dennings and their Beaux’ (1851); ‘Mrs. Washington Potts’; and ‘The Behavior Book’ (1853). She edited for many years *The Gift,* a popular annual for young women.

LESLIE, Frank (assumed name of Henry Carter), American publisher and journalist: b. Ipswich, England, 1821; d. New York, 10 Jan. 1880. He was educated at Ipswich; entered a mercantile house at 17; developed artistic abilities, and under the name of Frank Leslie contributed sketches to the *Illustrated London News.* The success of these led to his giving up commercial pursuits to become superintendent of engraving for that paper. In this position he produced valuable inventions, and made himself master of technicalities. Coming to the United States in 1848, he followed his profession here, and in 1854 founded the *Gazette of Fashion* and the *New York Journal.* In 1855 he began the publication of *Frank Leslie's Illustrated Newspaper* (now *Leslie's Weekly*), following these with the *Chimney Corner,* the *Boys' and Girls' Weekly,* the *Budget of Fun* and others. In 1867 he was appointed commissioner to the Paris Exposition, where he received a prize for his services to art. He married Miriam Florence Folline, of Louisiana, and she, having taken at his death, by legislative act, the name of Frank Leslie, successfully continued the business, from which she finally withdrew in 1902.

LESPINASSE, Julie Jeanne Eléonore de, zhü-lē zhän ĕl-ā-ō-nŏr lā-pĭ-näs, French letter writer: b. Lyons, November 1732; d. Paris, 22 May 1776. She was an illegitimate daughter of Madame D'Albon, and on the death of her mother she went to live with the Marquise De Vichy, the legitimate daughter of Madame D'Albon, and in 1754 became the companion of Madame Du Deffand (who had already become blind), at the urgent request of the latter. This position she occupied for about 10 years; but the jealousy and selfishness of Madame Du Deffand rendered her situation very uncomfortable. She gained the friendship of all the *élite* of Madame Du Deffand's society, such as Marmontel, D'Alembert and Turgot; and when the separation between the two ladies at last occurred her friends all adhered to her. Her earliest letters are addressed to a Spanish marquis, Gonsalvo de More, and the later ones to Count de Guibert, a mediocre poet and essayist. They are infused with passionate devotion and were published by the widow of Guibert in 1800, and appeared in English in Boston in 1903. Mrs. Humphrey Ward has made her character more famous by reproducing her career in ‘Lady Rose's Daughter’ (1903). Consult Asse, ‘Mlle. de Lespinasse et Mme. du Deffand’ (1877).

LESQUEREUX, lā-kē-rė, **Leo,** Swiss-American palæontologist: b. Fleurier, Neuchâtel, Switzerland, 18 Nov. 1806; d. Columbus, Ohio, 25 Oct. 1889. He was educated at the Academy of Neuchâtel, at Weimar and at the University of Berlin; was principal of the College of Chaux-de-Fonds (Switzerland) in 1829–34; made a special study of peat; and was appointed by the Neuchâtel authorities to examine the peat bogs of that canton. In 1844 he received from the Neuchâtel government a gold medal for his treatise, ‘Directions for the Exploration of Peat Bogs.’ In 1848 he came to the United States; was for a short time assistant to Louis Agassiz at Cambridge; and later became assistant to W. S. Sullivant (q.v.), in the study of American bryology, at Columbus, Ohio, where he resided until his death. He made particular investigation of the coal formations of the United States, more especially of the Pennsylvania coal flora, and he became the chief American authority on fossil botany. He published with Sullivant: ‘Musci Americani Exsiccati’ (1856; 2d ed., 1865), and ‘Icones Muscarum’ (1864); and with T. P. James ‘Manual of the Mosses of North America’ (1884). He also contributed (1880–84) three volumes on the coal flora to the Pennsylvania Geological Survey, which has been considered one of the chief American works on carboniferous plants; and three reports to the volumes published by the Hayden survey. He wrote more than 50 memoirs on scientific subjects. In 1864 he became a member of the National Academy of Sciences, and in 1888 of the Geological Society of London.

LESSEPS, lĕs'ĕps (Fr. lė-sĕps), **Ferdinand,** Vicomte de, French diplomat: b. Versailles, 19 Nov. 1805; d. 7 Dec. 1894. He entered the diplomatic service in 1828, and after being consul at various places was Ambassador to Madrid in 1848–49. In 1854 he went to Egypt at the invitation of the viceroy, Said Pasha. This gave opportunity for the development of a plan that had been developing in his mind for 20 years. He there sketched a plan for canalizing the Isthmus of Suez, obtained a concession from the viceroy for building the same and in 1856 published a report on the subject. He encountered all sorts of opposition, chiefly from the English, who feared that the new waterway would be under antagonistic control. Prominent engineers questioned its feasibility, and the Turks, under English influence, refused permission to utilize Turkish territory. The work was at last begun in 1859, and carried to completion under De Lesseps' supervision in 1869. (See Suez Canal). He also planned the unfortunate Panama Canal (q.v.), and after the company was dissolved in 1889, judicial proceedings were taken against De Lesseps and other directors for maladministration of funds and bribery, and he was condemned to imprisonment. As he was then much advanced in years, it is probable that the errors of this enterprise, were mainly chargeable to others, and that his reputation was borrowed for this work after he had passed his active usefulness. The plans were changed from time to time, much money was wasted, until it became evident that the work could not be completed with available funds, and the crash came in 1888, when De Lesseps was 83 years old. (See PANAMA CANAL). He was elected to the Academy of Sciences in 1875, and to the Académie Française in 1884. Among his writings are 'Mémoire à l'Académie des Sciences sur le Nile Blanc et la Soudan'; 'Principaux Faits de l'Histoire d'Abyssinie'; 'Letters, Journal et Documents relatifs a l'Histoire du Canal de Suez' (1875–81), crowned by the Academy; 'Souvenirs de Quarante Ans' (1887), and 'Origines du Canal de Suez' (1890). Consult biographies by Bertrand and Ferrier (1887) and by Smith (2d ed., 1895).

LESSING, Gotthold Ephraim, German dramatist and critic: b. Kamenz, Upper Lusatia, Saxony, 22 Jan. 1729; d. Brunswick, 15 Feb. 1781. In 1741 he was sent to the School of Saint Afra at Meissen. He was a diligent student, who, according to his tutor, was a horse that needed double fodder. He went to Leipzig ostensibly for a theological training; but he gave his chief attention to general literature, and contributed some interesting articles to literary journals. His academic studies having been concluded at Wittenberg, he went to Berlin, where he was active as journalist and critic, was employed by Voltaire, but soon quarreled with him, and whither he returned (1758) after a two-years' sojourn at Leipzig. He brought out 'Vademecum für Herrn Samuel Gothhold Lange,' in 1754, a criticism of a translation of Horace by Lange which had appeared some time before. The year following saw the issuing of a six-volume edition of his critical and dramatic works, including the first bourgeois *trauerspiel* in German, 'Miss Sara Sampson.' On his return in 1758 to the capital he instituted the famous series of 'Letters,' which were continued in 24 volumes down to 1765. In 1760 he became secretary to General von Tauentzien, governor of Breslau; and in that post continued for more than four years. His independence and fine sincerity led him to reject several opportunities of material advancement; as when he refused the chair of eloquence at Königsberg, because the tenure of it involved an annual eulogy of the king. In 1767 he became critic and director of the theatre at Hamburg which an association of wealthy merchants purposed establishing for the promotion of the national drama. The scheme shortly failed, and from 1770 until his death Lessing was librarian to the Duke of Brunswick at Wolfenbüttel, where he was valued only for the prestige he lent the little state. Lessing was the one who reformed German literature and set it on the way of national growth and progress. He became the foremost German writer of his time, and one of the more remarkable writers of all time, through his 'Minna von Barnhelm' (1767), the first national drama of Germany, and 'Laokoön' (1766), the best work of German criticism. 'Minna von Barnhelm' was an artistic presentation of contemporaneous life, and liberated the German drama from the slavish imitation of the French so exclusively preached by Gottsched. In it Lessing wished to rebuke not only the disposition toward aping the French, but also the indifference of the rulers to the soldiers that had won the Seven Years' War; and to eliminate the provincial hate which then so often existed in Germany, especially that between Prussia and Saxony. In 'Laokoön' Lessing appears as one of the greatest of critics. His eagerness for truth is remarkable; his revelation of hypocrisies and falsehoods, fearless. His chief argument is that for the establishment of a clear distinction between the plastic arts and poetry, the basic difference being determined to be that while art presents objects in space, poetry presents actions in time. Not all its contentions may be admitted; but Herder, who published a criticism in disagreement with many of its points, yet read it through three times in an afternoon and following evening, and praised it in high terms. Macaulay said it made him wonder and despair; and Goethe, who was greatly indebted to its teachings, declared that by it «all previous criticism was thrown away like an outworn coat.» Early in 1757 appeared the first of the 22 dramatic criticisms called the 'Hamburgische Dramaturgie,' which made way for the new national drama free of all French influence. His 'Nathan der Weise' (1778; in a good English rendering by E. Frothingham 1868) is the most celebrated of his dramas, and indeed perhaps the most generally familiar of all his writings. It was his ultimate answer to the theological controversialists who had begun their attacks with the publication by Lessing of an edition of portions of a manuscript work, obtained by him while in the ducal library, on the origins of Christianity and written by one Samuel Reimarus. To these 'Wolfenbüttler Fragmente' (1774–78) Pastor Goeze of Hamburg made the chief objection, and to Goeze Lessing gave his most elaborate rejoinders, such as 'Eine Parabel,' 'Axiomata' and 'Anti-Goeze.' He does not defend Reimarus, but he does defend free inquiry, and opens up the field for later Biblical criticism and the study of the growth of Christian institutions. Lessing having been directed by the Brunswick government to discontinue the controversy, made a poetic statement of his views in 'Nathan der Weise,' a remarkable plea for religious tolerance, and a declaration that true religion is one of character, not formula. The work has been criticised from the strictly dramatic viewpoint, but as a dramatic poem has been called one of the finest works of the 18th century. Others of Lessing's works are 'Emilia Galotti' (1772), a skilful tragedy; 'Briefe die Neueste Literatur Betreffend' (1758), with Nicolai, which first directed German thought to the study of Shakespeare, and 'Ueber das Wesen der Fabel' (1760). He married Eva König in 1776. She and their son died two years later and the author's last days were passed in sad contrast to his former gay and pleasant life. The only work of this period is 'Die Erziehung des Menschengeschlechts,' an exposition of his religious doctrine. «Lessing,» said Goethe, «wished to disclaim for himself the title of poet, but his immortal works testify against himself.» His battle against error in all domains had notable effect in Germany, and has not yet failed of an even wider stimulative interest. There are very many collected editions of Lessing's works but the best is probably that begun by Lachmann in 1838 (3d ed., by Muncker, 22 vols., Stuttgart and Leipzig 1886–1910). Good translations are Bell's 'Dramatic Works of Lessing' (2 vols., 1878) and Beasley and Zimmern's 'Laokoön, Dramatic Notes, and the Representation of Death by the Ancients' (1879).

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LESSING, Karl Friedrich, kärl frēd'rĭh, German painter, grand-nephew of G. E. Lessing (q.v.); b. Wartenberg, Silesia, 15 Feb. 1808; d. Karlsruhe, Baden, 5 June 1880. He was sent about 1822 to the architectural school of Berlin, to fit himself for an architect. After a severe struggle between duty and inclination, he yielded to his artistic inclinations and by the production of his 'Churchyard with Gravestones and Ruins' (1825) fixed his profession irrevocably. This picture produced a strong impression, and for a year or two the artist devoted himself to landscape; but coming under the influence of Schadow, established himself in Düsseldorf, and studied historical painting with enthusiasm and success. 'The Court Yard of the Convent — a Snow Scene,' is perhaps the most striking of all his landscapes. 'The Tyrant Ezzelin in Captivity refusing the Exhortations of the Monks' (1838), was his first important historical picture in the new style. It was followed by 'Huss before the Council of Constance' (1842), the 'Seizure of Pope Pascal II,' the 'Martyrdom of Huss' (1850), now in New York, and many others, under the influence of which the school of Düsseldorf divested itself of the strictly catholic spirit by which it was previously characterized, and adopted a bolder and more dramatic manner, and a greater freedom in the choice of subjects. Lessing, however, is distinguished from his associates by depth of thought, energy of expression, and vivid dramatic conception, at the same time that his pictures exhibit the hardness of outline and defective coloring peculiar to the Düsseldorf school. Consult Jordan, 'Ausstellung der Werke Karl Friedrich Lessings' (1880).

LESSON. See LECTIONARY.

LESTER, Charles Edwards, American author: b. Griswold, Conn., 15 July 1815; d. Detroit, Mich., 29 Jan. 1890. He studied law in Mississippi, and was admitted to the bar, but afterward spent two years at the Auburn Theological Seminary, and was duly ordained. The pulpit, however, proved not more congenial to his tastes than the bar, and he employed his time chiefly with the pen. He was appointed United States consul at Genoa, 1842–47, and was afterward prominent as a journalist and political speaker. He published 'Glory and Shame of England' (1841); 'Condition and Fate of England' (1842); 'The Artist, Merchant and Statesman' (1846); 'Life and Voyages of Americus Vespucius' (1846); 'Artists of America' (1846); 'My Consulship' (1851); 'Our First Hundred Years' (1874–75); and translations of Alfieri's 'Autobiography' (1845); Massimo d'Azeglio's 'Challenge of Barletta' (1845), and Macchiavelli's 'Florentine Histories' (1846); 'The Napoleon Dynasty' (1852); 'America's Advancement, or the Progress of the United States during their First Century' (1878); 'The Mexican Republic' (1878); 'Life of Charles Sumner' (1874).

LESTOCQ, lĕs-tŏk, **Jean Hermann,** French physician and adventurer: b. Celle, Hanover, 29 April 1692; d. Livonia, 23 June 1767. He was the son of a French Protestant surgeon who had left his native country on the revocation of the edict of Nantes, and when 21 went to Russia to seek his fortune. He was first employed by Peter the Great, but on account of his dissolute morals, was exiled to Kasan in 1718. Catharine I, on her accession in 1725, recalled him, and appointed him physician in the household of her second daughter, Elizabeth. He soon gained an influence over the mind of this princess, and when the imperial title devolved upon Ivan VI, he persuaded her that the only way of saving her own life was to seize upon the crown. She yielded to his suggestions, made the young tsar prisoner and seated herself on his throne. Lestocq was then appointed privy councillor, which gave him the rank of general, physician in ordinary to her majesty, and president of the medical college. His prosperity lasted but a few years. Charged with treasonable projects, he was arrested, tortured and exiled to Siberia. Peter III, on his accession, gave orders for his recall, and Catharine II gave him an estate in Livonia.

LESTODON, a genus of fossil animals of Patagonia, allied to *Mylodon*, and distinguished by the possession of canine teeth. See GROUND-SLOTH.

LESTRANGE, lĕs-trānj, SIR **Roger,** English journalist and pamphleteer: b. Hunstanton, Norfolk, 17 Dec. 1616; d. London, 11 Dec. 1704. He was probably educated at Cambridge. In 1629 he accompanied Charles I in his expedition against Scotland. In 1644 he formed a plan for surprising Lynn Regis, but was seized and condemned as a spy. He was, however, respited from time to time until he had been in prison four years, when he escaped to the Continent. In 1653 he returned to England, was licenser of the press from the Restoration until the close of the reign of James II, and edited the *Public Intelligencer* in 1663, the London

Gazette in 1665, and the *Observator* in 1681, the latter existing till 1687. In 1685 he was knighted, and given a seat in Parliament. He fell into disfavor in 1688, and his license was revoked, while he languished for a time in jail. He was author of a great number of coarse and virulent political pamphlets and translated Josephus, Cicero's 'Offices,' Seneca's 'Morals,' Quevedo's 'Visions' and other works of ancient and modern writers.

LESUEUR, Eustache, ės-tāsh lė-sü-ėr, French painter: b. Paris, 19 Nov. 1617; d. there, 30 April 1655. He was taught drawing by his father, a sculptor, and was afterward placed at the school of Vouet, where the Italian masters became his models. His masterpiece is the series of paintings executed for the Carthusian monastery in Paris in 1645–48. These pictures are now in the Louvre, and in 22 panels depict the principal scenes in the life of Saint Bruno. In 1650 he painted for the corporation of goldsmiths the 'Preaching of the Apostle Paul at Ephesus,' which was presented to the chapter of Notre-Dame, but has been now removed to the Louvre. He did much in decorating the old parish churches of Paris and among his later productions are some mythological scenes in the Hotel Lambert. His works are distinguished by purity of line, careful execution and are conceived in a mood of profound feeling.

LETCHER, John, American politician: b. Lexington, Va., 29 March 1813; d. there, 26 Jan. 1884. By his own efforts Letcher educated himself at Washington College and at Randolph-Macon. He then (1839) began the practice of law and at the same time entered politics as editor of the *Lexington Valley Star.* In all campaigns he took an active part on the Democratic side. In 1850 he was a member of the Virginia Constitutional Convention and from 1851 to 1859 Letcher was a member of Congress where his devotion to the public interest won him the title «Honest John Letcher.» From 1860 to 1864 he was governor of Virginia. He opposed secession but after the war began he organized the resources of Virginia for strong resistance and turned the State forces and equipment over to the Confederates. He was imprisoned for several months after the war and then returned to his profession. In 1876–77 he was a member of the State legislature.

LETCHWORTH PARK AND ARBORETUM. Letchworth park comprises a tract of land of 1,000 acres in extent, lying on either side of the Genesee River in Livingston and Wyoming counties, New York. The property was acquired in 1907, by gift from William Pryor Letchworth to the State of New York, and placed by the deed of gift by the donor in the permanent custody of the American Scenic and Historic Preservation Society. The park is a place of rare beauty and grandeur harmoniously blended, through which the Genesee River cuts its way. Within its boundaries are the three falls long known as the Upper Falls of the Genesee, or sometimes as the Portage Falls.

The custodian society, recognizing the need in America of a practical demonstration in the growing of forest trees, and with the purpose of increasing the timber resources of America, formulated plans for a forest arboretum soon after the property came into its hands. Respecting the function of the arboretum, the director stated, «The principle upon which the Letchworth Park Arboretum is established is that it shall consist of a permanent collection of the various species of the world's timber trees, likely to thrive in this northern climate, planted scientifically to test their value and illustrate the processes of development, so supplying not only knowledge for knowledge's sake but also knowledge for practical use.» The possibilities of the arboretum for extending exact knowledge of tree growth will be fully developed. The growth of the trees is measured periodically, their liability to disease is noted and their capacity for seed bearing; their behavior in pure stands and in mixture, their influence upon the forest floor, and other practical considerations bearing upon their value for commercial tree-planting is carefully observed and recorded. By this means the Letchworth park arboretum will aid materially in laying an exact scientific basis for the successful extension of practical forestry in the United States. Every step is taken, not only to ensure results of the highest scientific value from forest work at Letchworth park, but also to develop its usefulness as an object lesson to all park visitors.

In 1912 the custodian society planted the first tree in the arboretum. The nursery where the seeds are sown is an interesting educational feature of the arboretum work, for here the early stages in the development of timber trees may be observed — from the germination of the seed to the removal of the plants to the field plantations. Something over 500,000 plants have been transferred from the nursery rows to the fields, where they are grouped in blocks of an acre or more each, with a view, so far as possible, of showing color effects. All the important native and foreign trees that may thrive in that locality have been or will be planted, and will be made conveniently accessible by walks and drives through this living tree museum for means of study and observation of visitors to Letchworth park. In all 297 different species have been planted in the arboretum. It is expected by the custodian society that this living tree museum will be to the tree planter what the laboratory is to the student, a tangible, available demonstration of processes and results.

CHARLES M. DOW,
Director of Letchworth Park and Arboretum.

LETHARGY. See CONSCIOUSNESS, DISORDERS OF.

LETHBRIDGE, Canada, a city in Alberta, capital of the Medicine Hat District, 700 miles west of Winnipeg and 145 miles southwest of Calgary. It is in lat. 49° 42′ N. and long. 112° 51′ W., and is 2,990 feet above sea-level. It lies on the Old Man (Belly) River, the valley of which, 320 feet deep and a mile and a half wide, is there crossed by a trestle bridge 307 feet high and 1 mile 47 feet long. Situated in the centre of the part of the province lying south of the main line of the Canadian Pacific, it is the chief distributing point for that district. The original settlement, «Coal Banks,» sprang from the discovery by Sir A. T. Galt in 1882 of coal along the river banks and the opening of the Galt mines in 1883. The effort to market the coal by barges failed and in 1885 the "Turkey Trail" (narrow gauge) railway to Dunmore was constructed. The name Lethbridge, after the president of the company operating the mines and railway, was then adopted. The town, incorporated 1890, remained for 15 years or more a small coal mining and cattle ranching centre. The great influx of immigration then brought farmers who demonstrated that the land, despite assertion of the ranchers that it was too dry, was excellent for wheat growing and other agricultural activities. The extensive introduction of irrigation has greatly stimulated farming. Since 1900 its development has been chiefly as a wholesale and distributing centre to the surrounding farming country. Over 30,000,000 bushels of the 1915 grain crop passed through the Lethbridge Railway yards. But coal mining remains an important factor, the output of the immediate district being 3,000 tons daily. In 1906 Lethbridge was incorporated as a city. In 1913 it secured a unique charter from the provincial government, establishing the commission form of government. The city is governed by three commissioners, the mayor who is commissioner of finance and public safety, and the commissioner of public works and the commissioner of public utilities. An election for one of these (by proportional representation) is held every year, and each retains office for three years. The charter also provides for a system of initiative, referendum and recall whereby, upon a petition of a fixed percentage of the electors, an election is held to decide upon a new by-law or the recall of any of the commissioners. The city is supplied by a private company with gas from Bow Island, but the waterworks system, the electric-light and power systems and the street railway are owned and operated by the municipality. The city also owns and operates its own coal mine from which it draws all fuel required at its power plant and for heating municipal buildings. The water is taken from the river and a mechanical filtration plant has been installed. The sewage, first purified in a sewage disposal plant, is emptied into the river lower down. The streets are wide and have been well planted with trees. The buildings in the business section, which overlook Galt park, are of reinforced concrete and brick. The private residences are mostly of wood construction. There are three parks, one of which has an artificial lake of 91 acres. Pop. 9,436.

LETHE, lē'thē (Greek, *Lēthē*, forgetfulness), the mythological River of Oblivion in the lower regions. The water had the power of making those who drank it forget their former existence. Souls before passing into the Elysian Fields drank that they might have no recollection of their earthly sorrows; those who were destined to return to the upper world in new bodies drank that they might forget the pleasures enjoyed in Elysium. The name is also given to a daughter of Eris, as the personification of Oblivion.

LETTER OF CREDIT. See CREDIT, LETTER OF.

LETTER OF MARQUE. See MARQUE, LETTER OF.

LETTERN. See LECTERN.

LETTERS. See LETTERS IN LITERATURE.

LETTERS, The, of Marie de Rabutin-Chantal, Marquise de Sévigné (1626–96), present a correspondence of rare historical, social and personal interest in a style seldom approached in vivacity, limpidity and deftness. Some letters from others are included and the collection is extended beyond Madame de Sévigné's life, but of her own there are more than 1,100, extending from 1644 to within a few days of her death. Far the greater part of the letters are addressed to her daughter, Françoise Marguerite, Comtesse de Grignan (1646–1705), who handed down the collection to her own daughter, Madame de Simiane. Meantime many of the letters had appeared in connection with the correspondence of Madame de Sévigné's cousin, Bussy-Rabutin, in 1696 and 1697. Seven unauthorized and partial editions appeared between 1725 and 1728. Madame de Simiane, destroying her mother's letters, which she feared savored of Jansenism, committed her grandmother's to Chevalier de Perrin, who issued six volumes of them between 1734 and 1737, a seventh in 1751 and a second edition in eight volumes in 1754. He is thought to have used more editorial zeal than restraint. Most of the original letters were destroyed. The few that remain are now printed as they were written. The interest of the correspondence centres in the letters to Françoise, who married the Comte de Grignan in 1669. He was made lieutenant-general of Provence in 1670. Françoise followed him there in 1671. Mother and daughter visited one another in Paris and at Grignan from time to time, sometimes for long periods. Madame de Sévigné died and was buried at Grignan. When separated from Françoise she wrote copiously and often, in a hand that suggests an easy writer. Most of the letters are long, and 15 a month is in the early years nothing extraordinary. Love for this daughter was the absorbing passion of her life. But she was, as M. de Grignan said after her death, "a delightful companion" and her letters are companionable still. She had been carefully educated. Chapelain and Ménage were among her tutors. She had meditated Tacitus and had Italian and Spanish poets at command for apt citation. She was wealthy. She had and appreciated shrewd business counsel and had no illusions whither the extravagances of Versailles and the courtier nobles were leading the Old Régime. She was fond of society and moved easily in its highest circles, with La Rochefoucauld, Fouquet, the Cardinal de Retz and Madame de La Fayette among her intimates. She was exceptionally well informed of all that was going on before and behind political and military scenes. Her letters are thus of great value to the student of French character, for the attitude toward monarchy and the Church in the early years of Louis XIV and for the economic origins of the French Revolution. Wishing to tell all she thought, felt, heard and saw, she brought to the pleasant task a unique gift of style in which art blends subtly with nature. Written from Paris, from her uncle's abbey at Livry, from the baths of Vichy or her country house, Les Rochers, near Vitré in Brittany, the letters show sides of life and manners, of court and people, that elude the formal historian. They are also wonderfully entertaining, full of anecdote, witty sayings, sprightly gossip and genial fancies. They had become noted before her death and, long before official publication, had been held up as epistolatory models in a Latin poem 'Ratio conscribendæ epistolæ.' They are best edited by Monmerqué, Regnier, Mesnard and Sommer (14 vols., and an album of portraits, pictures of houses and facsimiles of letters, Paris 1862–68); more conveniently by Silvestre de Sacy (11 vols., Paris 1861–63). Among many partial editions a volume of translations by Mrs. Ritchie (Philadelphia, n. d.), Masson's 'Selections' (Oxford, n.d.) and 'Lettres Choisies' (New York 1905), may be mentioned. Edward Fitzgerald's posthumous 'Dictionary of Madame de Sévigné' (2 vols., London 1914) is very helpful. Good brief appreciations are given in biographies by Gaston Boissier (Paris 1888) and Miss Thackeray (Edinburgh 1881). The fullest memoir is by Walckemaer (5 vols., Paris 1845–52), the best is by Mesnard (in Vol. I of Monmerqué's edition, pp. 1–316). Consult also Puliga, 'Madame de Sévigné, her Correspondents and Contemporaries' (2 vols., London 1873) and Aldis, J., 'Madame de Sévigné, Queen of Letter Writers' (New York 1907).

BENJAMIN W. WELLS.

LETTERS, Proportionate Use of. Among printers experience has taught the frequency of use of letters, so that the following tables have been compiled:

E	1,000	M	272
T	770	F	236
A	728	W	190
I	704	Y	184
S	680	P	168
O	672	G	168
N	670	V	158
H	540	B	120
R	528	K	88
D	392	J	55
L	360	Q	50
U	296	X	46
C	280	Z	22

The following table shows the frequency of use of initial letters:

S	1,194	R	291
C	937	W	288
P	804	C	266
A	574	U	228
T	571	O	206
D	505	V	172
B	463	N	153
M	430	J	69
F	388	Q	58
I	377	K	47
E	340	Y	23
H	308	Z	18
L	298	X	4

LETTERS TO DEAD AUTHORS. Of all the volumes of literary criticism in English published within the past generation perhaps none is saner in content and more captivating in style than Andrew Lang's 'Letters to Dead Authors.' Written, as the author states, at the request of the editor of the *Saint James' Gazette,* and published in 1886, this little book originally included 22 «letters,» to which were added four others in the American edition of 1891. «For some reason,» says the brief preface to the latter edition, «the kindness of readers has favored a volume which is not the author's favorite.» But the reason is plain. Lang has in the main addressed his own favorite authors, and hence writes *con amore;* yet personal as is his criticism, it yet expresses the attitude of the majority of readers; and while his estimates, both literary and personal, are in the main «appreciative,» they are discriminating and sane. This excellent matter is couched in a style that varies with the subject but is always apt for its purpose — now grave, now gay, now lively, now severe; that ranges from rollicking humor, quiet mirth, sharp satire, to tenderness and pathos, and at times attains a really noble eloquence. In all this is sheer literary craftsmanship of a high order; and here is sufficient reason why «the kindness of readers has favored the volume.» But the abiding charm of the book lies in the fact that one actually feels identified with the writer of it as he talks with many old favorites —Herodotus and Horace, Rabelais and Molière, Scott and Dumas, Byron, Shelley and Poe, tersely sums up the fundamental qualities of their work and adequately expresses our gratitude for their contribution to the world's store of pleasure, beauty and truth. The warm, human, captivating «literary criticism» in these brief familiar studies is in itself literature of permanent interest and value.

MARION TUCKER.

LETTERS OF JUNIUS. See JUNIUS, LETTERS OF.

LETTERS IN LITERATURE. The letter, primarily a personal and utilitarian composition, passes over into the field of literary interest by processes often gradual and difficult to define; so that, although we commonly distinguish separate types, such as informal letters intended only for the eyes of those directly addressed and formal epistles composed with a view to ultimate publication, the distinction cannot be made with clearness in the actual history of the subject. Out of the private art of personal correspondence there must have arisen, at a very early period, the more public art of the literary letter. It was formerly supposed that the earliest extant collection of formal letters was the series (about 150 in number) of Greek epistles professing to have been written by the tyrant Phalaris, of the 6th century B.C. Around these, near the close of the 17th century, there developed a considerable controversy, connected with the so-called «Quarrel of the Ancients and Moderns»; and Richard Bentley, the philologist, in his famous 'Dissertation on the Letters of Phalaris' (1699), demonstrated — as is now universally admitted — that they are of comparatively late origin, perhaps of the 2d century A.D. Among the early genuine letters of the Greek period are those of the rhetorician Isocrates (d. 338 B.C.), nine in number; these are distinctively public rather than personal in character, being addressed to public persons and dealing largely with political themes. In like manner the philosopher Epicurus (d. 270 B.C.) made use of the epistle for the summary exposition of his doctrines. In the literature of the Romans the letter holds a large place, largely owing to the charm of the numerous letters of Cicero (d. 43 B.C.) and Pliny the Younger (d. 113 A.D.). In both these cases the letters were in the first place genuinely personal in character, but were in part written with a view to publication,— Pliny actually editing nine books of his. Of Cicero's one series is made up of letters addressed to his friend Atticus, another to his brother Quintus, another *ad familiares* — to various personal friends. These epistles introduce us to the social and political life of the great Roman period with an intimacy afforded by no other records of the age, and their form and style set the standard for letter-writing for many centuries. Pliny's letters are perhaps even more attractive than Cicero's because of the greater simplicity of his character; two of them, describing the eruption of Vesuvius in the year 79, are especially famous. Meantime the philosopher Seneca (d. 65 A.D.) had made use of the epistolary form for compositions of the nature of moral essays, in his 124 letters to Lucilius. Not to pursue the story of Roman letter-writing in detail, we may note that Quintus Aurelius Symmachus, near the close of the 4th century, wrote well-known letters in the manner of Pliny, of which 10 books were published by his son; that Apollinaris Sidonius, prefect and Christian bishop in Gaul in the 5th century, left a large and interesting correspondence descriptive of the provincial life of the empire; and that Cassiodorus, churchman and statesman under Theodoric in the 6th century, left 12 books *«variarum epistolarum,»* which are perhaps the best source of modern knowledge of the Ostro-Gothic dynasty. The Church fathers, too, both in the East and the West, made large use of the letter, whether personal or pastoral; and there were preserved and circulated epistles (to mention only a few names) of Basil and Chrysostom in the Eastern Church, and of Ambrose, Jerome, Augustine and Popes Leo I and Gregory I in the Western. In the mediæval period the traditions of both sacred and secular epistles were maintained, with emphasis on the former until we approach the time of the Renaissance, when there was a marked revival and cult of the latter. Doubtless for their human interest the letters of Abelard and Heloise in the 12th century, commemorating their ill-fated love, excel all other epistolary compositions of the age. These, of course, were purely personal; but already, as has been hinted, there was growing up an art of rhetorical letter-writing, commonly called *ars dictaminis*, due in part to the revival of the Ciceronian tradition and in part to the new humanism. The composition, especially, of public letters written by state officers and secretaries became the subject of treatises and of study in schools. One of the leaders in this art was Alberich (or Alberico) of the monastery of Monte Cassino (d. 1088), who wrote a *Breviarium de Dictamine*, followed, early in the following century, by the model letters (called *Rationes Dictandi*) of Hugo of Bologna. The rules governing epistolary composition, as formulated by these authorities, were elaborate and severe; thus Alberich taught that every epistle must have five chief divisions, — the *salutatio* or greeting, the *benevolentiæ captatio* or introduction designed to produce a favorable impression, the *narratio*, the *petitio*, and the *conclusio*. Later works also classified the types of letters to be studied, as Didactic, Deliberative, Demonstrative, Judicial, or Familiar, with many sub-types after the manner of rhetorical pedantry. It is obvious that the epistolary art would be among those sedulously cultivated in Italy, from the 13th to the 16th centuries; and in fact the collections and treatises representing it during that era are countless. Especially precious are the letters of Dante (such as those addressed to the emperor, Henry VII, to the Italian cardinals, etc.) and of Petrarch; the latter collected his, and prepared them for publication, classifying them as «Familiar Correspondence,» «Correspondence in Old Age,» «Letters without a Title,» etc., with a curious appendix called «Epistle to Posterity.» Somewhat later, the letters of Bembo (d. 1547) and Aretino (d. 1556) were especially valued for their elegance, and were widely collected and republished. At the same period in Spain, Antonio de Guevara distinguished himself as an epistolarian, and his *Epistolas Familiares* (1539), which came to be called the «Golden Epistles,» were even more largely circulated and imitated than any of the Italian school; they were published in English in both the 16th and 17th centuries. Another Spanish collection of note was that of the letters of Antonio Perez (d. 1611). Of the early Reformers the chief epistolarian was Erasmus, who recorded the fact that his enormous correspondence sometimes required him to write 40 letters a day. Though his letter-writing was often informal enough, he also studied the art of the rhetoricians, and himself wrote a manual *De Conscribendis Epistolis*. The letters of Melanchthon and of Luther have also, of course, a high place in the personal literature of the Reformation; and Ulrich von Hutten, with collaborating friends, turned the epistolary art to the uses of satire in his famous 'Letters of Humble Men' (*Epistolæ Obscurorum Virorum*), published 1515–17.

In France the impulse of the Renaissance had effects similar, though less notable, to those in Italy. Among the chief early models of French letter-writing are the collections of the letter, of Voiture (d. 1648) and Jean Balzac (d. 1654). Those of Balzac in particular were often reprinted. Pascal soon made use of the form for serious philosophic purposes in the famous *Lettres Provinciales* (1656–57). It was in the 18th century, however, that French letter-writing became distinguished as one of the forms most representative of the spirit of the age; notable examples are the correspondence of Voltaire (d. 1778), of Rousseau (d. 1778), of Marianna Alcoforado (d. 1723), of the Marquis du Deffand (d. 1780) and of Madame de Staël (d. 1817). Pursuing the subject hastily into the 19th century, we may note such attractive epistolarians as Sainte-Beuve, Prosper Mérimée, George Sand, and the brothers Edmond and Jules de Goncourt. The Germans have never distinguished themselves strikingly in letter-writing viewed as an art, though from the days of Luther to those of Wagner they have furnished examples of letters important for their substance. Especially notable for literature is the correspondence of Lessing and Moses Mendelssohn, in the 18th century, and that of Goethe and Schiller. Other interesting epistolarians are Herder, the brothers Schlegel and the brothers Grimm.

Few examples of the letter-writing of England survive from the pre-Elizabethan period, aside from official correspondence in state papers and the like. The outstanding exception is the collection of Paston Letters, written by various members of a Norfolk family, between 1424 and 1509, and first published (in part) in the late 18th century (not fully until 1875); their value is historical, not literary. With the Renaissance the conception of letter-writing as a literary art naturally entered England, being marked, for example, by the publication of such collections as the Letters of Guevara, translated into English by Edward Hellowes in 1574 and Sir Geoffrey Fenton in 1575 (Fenton added ‘Letters of other Authors, Latin, French and Italian’). Still earlier, in 1568, had appeared William Fullwood's ‘Enimie of Idlenesse: Teaching the maner and stile how to endite, compose and write all sorts of Epistles and Letters,’ a work which became exceedingly popular and was often reprinted; it included translations of letters by Latin and Italian writers. Of a humbler and more utilitarian character were collections of the “complete letter-writer” order, such as a work of 1618, probably compiled by Gervase Markham, called ‘Conceited Letters, newly laid open: or a most excellent bundle of new wit, wherein is knit up together all the perfections or art of Episteling.’ Far more value, of course, attaches to the personal correspondence of certain of the great personalities of the period. Thus we have a considerable body of Bacon's letters, first published in 1702 and in subsequent collections, and another of Sir Philip Sidney's; of special interest is the Latin correspondence of Sidney and Hubert Languet, translated into English in 1845. A minor Elizabethan writer, of no little interest to students of the period, was Gabriel Harvey, who was fond of preserving and publishing his letters; and it is to him we owe the publication of some of Spenser's, in a collection called ‘Letters to and from Edmund Spencer’ (1579–80). John Donne's fascinating ‘Letters to Several Persons of Honor,’ written between 1600 and 1630, were published by his son in 1651.

The chief developer of the English letter as a literary form was James Howell, a traveler, diplomatist and pamphleteer, who in 1645 published the first series of his ‘Epistolæ Ho-elianæ: Familiar Letters, Domestic and Foreign, Divided into Sundry Sections, partly Historical, Political, Philosophical.’ These letters were represented as having been addressed to various persons, but appear to have been really of the nature of essays in epistolary form, and they have a place of some significance in the development of the essay in the 17th century. Three later volumes followed, and many reprints. Of the same period are the private letters exchanged by Sir William Temple and his betrothed, Dorothy Osborne; Mistress Osborne's letters represent a delightful blend of propriety and spirited informality. Those of Sir Henry Wotton, diplomatist and man of letters (d. 1639), were published with his other manuscripts in the interesting collection called ‘Reliquiæ Wottonianæ’ (1651). Other collections of the same period were ‘Loveday's Letters, Domestic and Foreign,’ published by the writer's son in 1659, and Sir Richard Bulstrode's ‘Original Letters written to the Earl of Arlington’ (1674). The versatile Duchess of Newcastle published in 1664 a fictitious or ideal series called ‘Two Hundred and Eleven Sociable Letters.’ Milton's ‘Letters of State,’ translated from the Latin, were published by his nephew, Phillips, in 1694; while in 1743 appeared an additional volume, called ‘Original Letters and Papers of State . . . found among the Political Collections of Mr. John Milton.’

In the 18th century the field of English letters becomes still more rich and varied, though the tendency is by this time toward more and more informality. Most intimate of all the collections are the letters of Swift to Esther Johnson, commonly called the ‘Journal to Stella’; these were written from 1710 to 1713. The chief letter-writer of this age, however, was the poet Pope, who returned to the Roman practice of composing letters which should serve the purpose of the hour and at the same time be preserved as works of epistolary art. His habit of altering the original text, and of professing to have addressed other correspondents than the real ones, together with the extraordinary duplicity he practised in arranging for their publication, form a melancholy story, first fully revealed in our own time in the Elwyn-Courthope ‘Life of Pope.’ Two of his correspondents, Lord Bolingbroke and Lady Mary Montagu, also won separate distinction in the epistolary art. Bolingbroke's best-known letters are in fact essays on politics or philosophy, addressed to one or another friend,— such as the ‘Letters on the Study and Use of History,’ written about 1735 but published 1752, the ‘Letter to Sir William Wyndham,’ and various letters to Pope. Lady Montagu solaced a prolonged residence in Constantinople by much letter writing, represented by the ‘Turkish Letters’ of 1716–18, published only after her death. Various other collections were made from manuscripts in the hands of her family and friends, the number of letters in the end reaching some 450. Other ladies, less learned and brilliant than Lady Mary, were nevertheless able to win a reputation as epistolary recorders of court gossip and the like; among the resulting collections are ‘Letters to and from Henrietta, Countess of Suffolk, and her Second Husband, the Hon. George Berkeley, from 1712 to 1767,’ and ‘Correspondence between Frances, Countess of Hertford and Henrietta Louisa, Countess of Pomfret, 1738–41,’— both series being published only in the 19th century. Far more famous were the letters of Lord Chesterfield to his natural son, Philip Stanhope, published in 1774, the year following his lordship's death; these were reprinted at intervals for at least a century, being viewed in some quarters as models of advice to the young, in others as shocking examples of cynicism and worldliness. Most of the men of letters of this age devoted their leisure to prolific, often brilliant, correspondence; among those whose letters still well repay the reader are Sterne, Gray, Smollett, Garrick and Cowper. But the prince of the epistolarians was Horace Walpole, “trifler and fop,” who devoted the huge leisure of a long life to the most tireless and animated body of correspondence in our literature. The first volume of his letters appeared in 1798, the year following his death; subsequent collections in the 19th century have brought the number of letters beyond 3,000. Frances Burney (later Madame d'Arblay), a lady of the queen's bedchamber and novelist, was a close rival to Walpole in the power of sprightly representation of contemporary life; her letters, though primarily of the 18th century, were published with her 'Diary' in 1842-46. With reference to this period it must also be recalled that it was the demand of a publisher for a collection of model letters for the use of young persons of moderate attainments which led Samuel Richardson to embark on his epochal career as epistolary novelist with 'Pamela' (1740); and that Gilbert White's 'Selborne' (1789), distinguished as a classic both in literature and natural history, was made up primarily of personal letters addressed to the writer's fellow-naturalists, Pennant and Barrington. In the 19th century the art of letter-writing tended to decline, owing to diminished leisureliness of life and the progressive loss of the old courtly dignities and formalities of manner and style. Nevertheless many English men of letters maintained the epistolary tradition among their friends. The chief of these is Charles Lamb, whose letters are inferior to none of the preceding era in charm of wit and wisdom; indeed it was through them that he may be said to have practised the art of the familiar essay, in which he stands supreme among the moderns. Other brilliant letter-writers of the century are Byron, De Quincey, Macaulay, Sydney Smith, Edward Fitzgerald, Thackeray and Stevenson; and — in more serious vein — Ruskin, George Eliot and Carlyle. The Emerson-Carlyle correspondence is a noble monument of philosophic and international friendship. Besides Emerson, among the Americans, James Russell Lowell and Charles Eliot Norton have won distinction for their letters. Others who have preserved the tradition of the art, even in the days of typewriter and telephone, will doubtless be revealed by time.

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LETTERS PATENT. See PATENTS.

LETTIC LANGUAGE AND LITERATURE, the speech and literary production of the Letts, who inhabit Courland, Livonia, Kovno, Pskov and Vitebsk, also in East Prussia, Brazil and in the Lettish colonies in the United States. The language is spoken by 1,750,000 people. It forms with Lithuanian and the now extinct Old Prussian, the Baltic subdivision of the Indo-Germanic linguistic family. Lettic is distinguished from Lithuanian by a phonology further removed from the Indo-European standard, and by its accent, which always falls on the first syllable. In a few points it is more archaic than Lithuanian. For instance, it retains the Indo-Germanic *s* and *z* which in the sister language has been modified to *sz* and *ž*, and the original brief vowels, which in many cases have become long vowels in Lithuanian. It is divided into numerous dialects, the chief of which are the following: East Lettic, the Mitan dialect, which is the standard literary form, the North Lettic, spoken in north and northwestern Courland and in the Riga districts of Livonia. Lettic has only two genders and two numbers, although there remain traces of the dual number. It also retains seven of the eight cases of the Indo-Germanic family, has only the three tenses of the verb (past, present and future) and the indicative, conditional and imperative moods. A reflexive form is added to the verb by the addition of *s*. Periphrastic forms are numerous. The vocabulary contains a great number of German, Russian, Esthonian, Finnish and Scandinavian words, and the influence of these languages is discernible in much of the native vocabulary.

Until the last century the language was greatly neglected and a few German scholars were the first to describe and investigate it. Within recent decades the Letts themselves have given more attention to their language and the movement has resulted in an increased and greatly improved literary output. The earliest literary works in Lettish were translations of Luther's 'Catechism' (Königsberg 1586). Undeutsche Psalmen' and 'Gesänge' (1587), a translation of the Bible (Riga 1685-89) and other works almost exclusively of a religious or didactic character, and translations from the German. G. F. Stender (d. 1796) wrote a grammar and a compendious dictionary of Lettish, which gave a new impetus to the study of the language. He wrote also 'Augustas gudrîbas grahmata' (1776), a work containing the elements of astronomy, geography, history, etc., and also stories and tales which helped to popularize the language and at once arrested its decline. The first Lettish comedy was written by his son, Alexander Stender. The close of the 18th and the opening decades of the 19th century saw a great literary revival among the Letts, who began to take pride in cultivating their language as a literary medium. Periodicals were founded, including the *Latweeschu Awise* (1822—) and *Magasin* (Mitau 1827—), and a vigorous effort was made to develop a national literature free of German and Russian influences. The classics of the western European tongues were translated and exerted a marked influence on the literary development of Lettish. Lettish poems, novels and romances issued from the press in increasing numbers, and works on economics and sociology ushered in a new era in national culture. Among the literary figures of the 19th century stand forth pre-eminently Jur Allunan, the Kaudoit brothers, Neikens, Pumpurs, Kronwald, Lautenbach, Rosenberg-Aspasia, Blanman, Rainis-Pleekschan, Janson, Zeifert and Lap. By the year 1900 there existed in Lettish about 2,500 works and 10 periodicals. The folksongs of the Letts are numerous and some are very beautiful. The best are contained in the first numbers of 'Latweeschu tantas dfeesmas' (Leipzig 1874 et seq.). Schleicher published a collection of tales and proverbs (Weimar 1857).

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LETTRES DE CACHET, lĕt-r-dĕ-kä-shä, in France, a name given to the warrants of imprisonment issued by the kings before the Revolution. All royal letters (*lettres royaux*) were either *lettres patentes* or *lettres de cachet*. The former were open, signed by the king, and countersigned by a minister, and had the great seal of state appended. Of this kind were all ordinances, grants of privilege, etc. But these checks on arbitrary power did not exist with regard to *lettres de cachet,* also called *lettres closes,* or sealed letters, which were folded up and sealed with the king's little seal (*cachet*), and by which the royal pleasure was made known to individuals or to corporations and the administration of justice was often interfered with. It was not always for political reasons that *lettres de cachet* were obtained; sometimes private persons got troublesome members of their families brought to reason in this way. The lieutenant-general of the police kept forms of *lettres de cachet* ready, in which it was only necessary to insert the name of the individual to be arrested.

LETTS, lĕts, a Slavonic people closely akin to the Lithuanians, inhabiting a portion of Russia. Their language, along with the Lithuanian and Old Prussian (extinct), forms the Lettic or Lithuanian branch of the Indo-European family of tongues. The Letts number about 1,000,000.

LETTSOMITE, or CYANOTRICHITE, a mineral consisting of hydrous copper aluminum sulphate, $4 CuO. Al_2O_3SO_3. 8 H_2O$. A minor ore of copper in the Tintic district, Utah.

LETTUCE, lĕt'ĭs, a genus (*Lactuca*) of hardy annual and perennial herbs of the order Compositæ. Less than 10 of the 100 recognized species, which are distributed mainly in the northern hemisphere, are in cultivation, and some botanists consider these to be merely forms of three or perhaps two species. They are characterized by opposite leaves of various forms, and white, yellow or blue flowers in heads which are arranged in small panicles. The only species used in America, the common garden lettuce (*L. sativa*), is an annual whose natural prototype is unknown, but is supposed to be *L. scariola,* an Asiatic species.

Lettuce is one of the oldest food-plants, having been used, it is said, by Persian royalty more than 2,000 years ago. To-day it is unquestionably the most widely used of all our materials for salads, and has developed an innumerable host of varieties of great diversity of form. They are somewhat roughly divided into two general groups: heading, in which the leaves form a cabbage-like head; and cutting, in which the leaves are more loosely arranged. In each of these groups are forcing and outdoor varieties. A third group, the cos or romaine varieties, which may be considered a subdivision of the cabbage group, consists of long, narrow-headed kinds, whose outer leaves must be tied above the head to properly blanch the inner ones. They are specially valued as summer lettuces, because of the ability to produce leaves of good flavor in spite of considerable heat.

Lettuce grows best in cool weather. It requires a rich open soil and clean cultivation; plenty of sunlight in the cool seasons and partial shade in the warm. The seed may be sowed in a hotbed, where the plants may be either allowed to develop, or from which they may be transplanted to the garden, 8 to 12 inches being allowed between them. Immense quantities of lettuce are forced in greenhouses during the winter, and from the trucking regions of the South, where the plants are grown with only sun heat in canvas-covered beds, the markets are supplied during the winter with thousands of carloads.

When grown under glass lettuce is sometimes attacked by so-called plant diseases — leaf-spot, rust, mildew and drop or rot. These may be very largely if not wholly controlled by good management, especially with respect to ventilation, the temperature being kept lower than that which is favorable to the growth of the fungi. Sterilizing the soil with live steam for an hour or more is practised and believed by many large growers to destroy the spores. The operation is performed a day or so before planting.

LEUCADIA, lĕf-kä-dē'ä, or **LEUKAS.** See SANTA MAURA and CAPE DUCATO.

LEUCÆMIA, an incurable but rarely occurring disease of unknown origin, characterized by enlargement of the spleen and lymphatic glands, and the changes in the blood consisting in a decrease of the number of the red cells, diminution of the amount of hæmaglobin in each cell, and great increase in the number of the leucocytes or lymphocytes. The disease may come on rapidly, with anæmia and loss of flesh and strength; usually the onset is insidious, the deterioration of the general health or the swelling of the spleen or glands being first noticed. The least uncommon form of the disease shows peculiar changes in the bone-marrow; next in frequency is the form in which only the spleen and marrow are changed, and rarest of all is the form in which the glands are changed (the lympatic). Besides the increase in the number of the leucocytes, a form of the cell found only in the bone-marrow appears in the blood. The symptoms, which almost invariably include a fever of about 102°, difficulty in breathing, occasional hemorrhages, etc., are due to the loss of nutrition of the tissues, to the anæmia, to the pressure of the enlarged spleen on the vital structures in the abdomens and to the pressure of the enlarged glands. The glands most commonly enlarged are the chains along the neck, those in the axilla, the abdominal glands, the glands of the groin and those of the thorax. They may be barely large enough to be felt or may form bunches in these parts that are plainly visible. The disease progresses for months or years with intervals of considerable improvement sometimes obtained from arsenic in large doses.

LEUCIN (Greek, «white»), a white substance, resembling cholesterin, first discovered by Proust in putrefying cheese and afterward shown by Braconnot to be formed (together with other products) by the action of sulphuric acid upon animal matters. It is best prepared by the prolonged boiling of horn shavings in sulphuric acid, neutralizing with lime, precipitating excess of lime with oxalic acid and then evaporating to crystallization. Leucin and tyrosin are thrown down together, but they may be separated by redissolving in water and recrystallizing, the tyrosin then coming down first. Leucin has the chemical formula $C_6H_{11}O_2.NH_2$, and is known to the chemist as «amido-hexoic acid.» (See AMIDE and HEXOIC ACID). It may be sublimed, but if it be heated to 338° F. it melts, becoming simultaneously converted into amylamine, carbon dioxide and ammonia. It is insoluble in ether, but soluble to some extent both in water and in alcohol. Leucin is said to occur in healthy calf's liver, and in certain other healthy tissues, such as the brain of the ox. It occurs also in certain of the products eliminated by the human skin, but its presence in the urine or in any of the internal organs of man is regarded as indicative of a serious pathological condition. Thus leucin is found in the liver in phosphorus poisoning and in acute yellow atrophy, and also in typhus fever and smallpox. In the healthy body leucin and tyrosin are probably converted into urea and eliminated as such.

LEUCIPPUS, lū-sĭp'ŭs, Greek philosopher, flourished between the 4th and 5th centuries B.C. To him is attributed the first idea of the atomic system afterward perfected by his disciple Democritus. Kepler and Descartes were much indebted to the doctrines of these masters for the explanation of the planetary vortices.

LEUCITE, a native silicate of aluminum and potassium, having the formula $KAl(SiO_3)_2$, and crystallizing in forms that are isometric at 900° F., but pseudo-isometric at ordinary temperatures. Its anomalous double refraction has been the subject of much study and discussion. The mineral is white or gray in color, and has a hardness of from 5.5 to 6, and a specific gravity of 2.50. It occurs more particularly in recent volcanic rocks, and Vesuvius is the best-known locality for it. It is also found in considerable quantity in the Green River Basin, Wyoming. Leucite may be converted into the mineral analcite by the action of a soda solution, and the inverse transformation of analcite into leucite is also possible.

LEUCOCYTES. See BLOOD.

LEUCOMAINES (Gk. λεύκωμα, white of egg), certain nitrogenous organic basis found as products of metabolism in living organic tissues. They may be extracted from fresh beef by warm water and oxalic acid, together with a little oxygen. The solution is boiled, filtered, evaporated and extracted with alcohol several times. The alcoholic solution is precipitated with ether several times, and its several components are isolated by various means. The bases thus obtained are xanthocreatinine, $C_5H_{10}N_4O$; chrusocreatinine, $C_5H_8N_4O$; amphicreatine, $C_9H_{19}N_7O_4$; pseudocreatine, $C_4H_8N_3O$; $C_{11}H_{24}N_{10}O_5$, and $C_{12}H_{25}N_{11}O_5$. Some of the leucomaines are toxic. They correspond to the alkaloids (q.v.) in plants. See METABOLISM.

LEUKOPLASTS. See CHROMATOPHORES.

LEUTHEN, loi'tĕn, or **LISSA**, Prussia, a village nine miles west of Breslau, Lower Silesia, which gives its name to the battle gained here by Frederick the Great, 5 Dec. 1757, over Prince Charles of Lorraine. The Austrians numbered about 90,000 and the Prussians 34,000. The Austrians lost 10,000 in killed and wounded, 12,000 were taken prisoners, besides considerable war munitions, and Silesia was regained. Pop. 800. See SEVEN YEARS' WAR.

LEUTZE, loit'sĕ, **Emanuel**, American artist: b. Gmünd, Würtemberg, 24 May 1816; d. Washington, D. C., 18 July 1868. He was brought to the United States in infancy and early displayed a talent for portrait painting. He studied at Düsseldorf under Lessing and lived abroad for many years after 1841. Among his works, which are largely historical, are ‹Columbus before the Council of Salamanca›; ‹Columbus in Chains›; ‹Columbus before the Queen›; ‹Landing of the Norsemen in America›; ‹Washington Crossing the Delaware,› perhaps his best-known work; ‹Washington at Princeton›; ‹Lafayette in Prison at Olmütz Visited by his Relatives.› In 1860 he was employed by the United States government to make a large mural painting entitled ‹Westward the Star of Empire takes its Way› on one of the stairway walls in the national Capitol. His detail has been criticized and some of his work pronounced crude, but it is always striking and effective. His principal figures always suggest power.

LEVANT, lę-vănt' («sunrise,» «orient»), in geology, a term applied by Henry Rogers to the fourth series of the Appalachian Palæozoic strata, called in New York the Medina group, and of equivalent age to the May Hill Sandstone or Upper Llandovery of England. The name is given to signify metaphorically the sunrise period of the Palæozoic day. Its maximum thickness is above 2,000 feet, and most mountains of the Appalachian series are outcroppings of the Levant. There are few organic remains, chiefly marine shells and fucoids.

Geographically the word is a name applied to designate the coast of the Mediterranean immediately east of Italy, including the islands of the Ægean, Egypt, Asia Minor and Syria.

LEVANT, The. See CONSTITUTION, THE.

LEVANT MOROCCO, a superior quality of Morocco leather, originally imported from the Levant, being made from the skin of Angora goats. See LEATHER.

LEVASSEUR, lė-vä-sėr, **Pierre Emile,** French political economist and geographer: b. Paris, 8 Dec. 1828; d. July 1911. He was educated at the College Bourbon and the Ecole Normale Supérieure, and after holding several important educational posts became in 1876 professor of geography at the Ecole Libre des Sciences in Paris. He was especially prominent in regard to geographical study in French school and in addition to a series of geographies was author of ‘Public Moneys among the Romans’ (1854); ‘The Gold Question’ (1858); ‘The French Population’ (1889–91); ‘Agriculture of the United States’ (1894); ‘The American Workman’ (1900); ‘Summary of Political Economy’ (1905); ‘History of the Commerce of France’ (1911–12). He was a member of the Academy of Moral and Political Sciences and a commander of the Legion of Honor. He visited the United States in 1893 in connection with the Columbian Exposition.

LEVEE, lĕ-vē′ or lĕv′ē (from the French word *lever,* to rise, and the time of rising). (1) In social usage, levee is a word used in high life or court language for the ceremonial visits which great personages receive in the morning, as it were at their rising. The levee is distinguished from the drawing-room, inasmuch as at the levee of a gentleman, gentlemen only appear, and at the levee of a lady, only ladies, while at the drawing-room, ladies and gentlemen both are admitted. The meaning is now more extended and the term is applied chiefly to the stated occasions on which the king or queen of Great Britain publicly receives those subjects whom their rank entitles to the honor. On the first presentation of daughters of dukes, marquises and earls, it is customary for the queen to kiss them on the cheek. The term is little used in the United States. (2) In hydraulic engineering, an embankment raised on the margin of a river to prevent inundation. That part of Louisiana which lies on the lower Mississippi was formerly subject to the annual overflow of the river, by which immense damage was done to the land. To guard against these inundations, levees of earth have been thrown up for more than a thousand miles along the river banks to a height sometimes of 15 feet, with a breadth of 30 feet at the base. This construction began about 1720 in New Orleans and was carried on locally and irregularly until 1882, when the Mississippi River Commission began its work under the United States government. In front of New Orleans the levee is very broad and serves as a wharf, steamboats and other vessels being moored to it. Breaches sometimes occur in the levees, when the water rushes through and does great mischief; these breaches are called crevasses. Consult Humphreys, ‘Floods and Levees of the Mississippi River’ (1914). See MISSISSIPPI LEVEE SYSTEM; NATURAL LEVEE.

LEVEL. (1) In mining, a horizontal gallery or passage. The workings at different depths are said to be at the different levels — the 50 or 60 fathoms level, and so on. A level which opens to the surface at the side of a valley is called a day level, and being graded affords a means of natural drainage without pumping. A drowned or blind level is a drainage gallery which has the form of an inverted siphon. A dip-head level is one which proceeds from the foot of the engine-shaft right and left, and from which the rooms diverge. (2) In surveying and engineering, an instrument for indicating a horizontal line or determining the position as to horizontality of an object or surface to which it is applied, and then determining the true level, or the difference of rise or fall between two or more places. There are numerous levels, varying in form, size, arrangement or construction, according to the purpose for which each is intended; as, for instance, the carpenter's, mason's, gunner's or surveyor's levels, the mercurial, water and spirit levels, etc. All may be divided into three classes: (a) The simplest, such as the mason's or carpenter's level, in which the vertical line is determined by a plumb line and the horizontal by a line perpendicular to it. (b) Those in which the horizontal line is determined by the surface of a fluid at rest; as in the water and mercurial levels. (c) Those in which the horizontal line is determined by a bubble of air floating in a fluid contained in a glass tube, as a spirit level.

LEVELERS, the name of an ultra-reform party in Great Britain, which arose in the army of the Long Parliament about the year 1647 and was put down by Fairfax. The movement was partly political and partly religious; they aimed at the establishment of an equality in titles and estates throughout the kingdom. While they condemned all religious strife and differences, they mutinied on various occasions and a number were killed before the party was suppressed.

LEVELING. See SURVEYING.

LEVEN, Loch, lŏh lē′vn or lĕv′n, Scotland, a lake in the county of Kinross, of oval shape, four miles long, two miles broad; greatest depth, 90 feet. It contains several islands, on one of which are the remains of the historic castle of Loch Leven, in which Mary Queen of Scots was confined after her separation from Bothwell and where she escaped shortly before the battle of Langside. The trout fishing of the lake is famous.

LEVER, lē′vėr, **Charles James,** Irish novelist: b. Dublin, 31 Aug. 1806; d. Trieste, Austria, 1 June 1872. He was educated at Trinity College, Dublin, and after studying medicine, partly at Göttingen, he obtained the degree of bachelor of medicine from Trinity College in 1831. During the prevalence of cholera in 1832 he gained considerable reputation for his skill and devotion in the treatment of that disease. In March 1834 he contributed his first paper to the new *Dublin University Magazine,* of which he was editor 1842–45. The first chapter of ‘Harry Lorrequer,’ a designation which he afterward made famous as his *nom de-plume,* appeared in the February number for 1837. He removed to Florence in 1847, where he held a diplomatic position, was English consul at Spezzia in 1858 and at Trieste 1867–72. He published ‘Harry Lorrequer’ (1837); ‘Charles O'Malley’ (1840); ‘Tom Burke of Ours’ (1844); ‘Jack Hinton’; ‘Arthur O'Leary’ (1844); ‘Roland Cashel’ (1850); ‘The Bramleights of Bishops Folly’ (1868); ‘Lord Kilgobbin’ (1872), etc. The rollicking character of the earlier of these was intensely national, but his later novels were more thoughtful and artistic.

LEVER, lĕv'ĕr or lē'vĕr, a mechanical device for the transmission and transformation of power. It is essentially a *rigid* structure, in which case it acts as a straight bar, no matter what its conformation, pivoting upon a fixed point called the «fulcrum.» By means of the lever a great force operating over a short distance is obtained at the expense of a small force operating over a long distance. The crowbar is the commonest simple example in practice. With it a stone weighing 500 pounds may be raised two inches by moving the handle end of the bar downward 20 inches, the fulcrum being so placed that the distance from the hand to the fulcrum is 10 times as long as from the fulcrum to the stone. It will be noted that the fulcrum has to carry the sum of the weights at the two ends of the lever — in the example quoted, 550 pounds. The lever is operated under three different conditions: (1) Where the fulcrum is between the power and the resistance, as in lifting the stone with a crowbar; (2) where the resistance is between the power and the fulcrum, as in a nutcracker; (3) where the power is between the resistance and the fulcrum, as in a sugar-tongs or a sheep-shears. In the last instance the power has to be larger than the resistance, as it operates on the small section of the lever to produce a less power over a longer distance at the resistance end. The equation of the lever is: The power multiplied by its end of the lever equals the resistance multiplied by its end.

LEVERETT, lĕv'ĕr-ĕt, **Frank,** by family tradition descendant of John Leverett, American colonial governor (q.v.), American geologist: b. Denmark, Iowa, 10 March 1859. He was educated at Denmark Academy and the Iowa Agricultural College. In 1886 he entered the United States Geological Survey; was assistant geologist 1890–1900, and since 1901 has been geologist; also since 1909 lecturer on geology, University of Michigan. His special lines of investigation are glacial geology and water resources. He is a member of many scientific societies, both national and international. His publications include ‘Water Resources of Illinois’ (1896); ‘Water Resources of Indiana and Ohio’ (1897); ‘The Illinois Glacial Lobe’ (1899); ‘Glacial Deposits of the Erie and Ohio Basins’ (1901); ‘Flowing Wells and Municipal Water Supplies of the Southern Peninsula of Michigan’ (1906); ‘Comparison of North American and European Glacial Formations’ (1910); ‘Surface Geology of Michigan’ (Northern Peninsula 1911; Southern Peninsula 1912); ‘Surface Geology of Minnesota’ (northwest quarter 1915); ‘Pleistocene of Indiana and Michigan and History of the Great Lakes,’ with Frank B. Taylor (1915); and various shorter reports and papers.

LEVERETT, Sir **John,** American colonial governor: b. England, 1616; d. Boston, Mass., 16 March 1679. At 17 he emigrated to America with his father and settled in Boston. He returned to England in 1644 to take part in the struggle between the Parliament and the king, and as commander of a company of foot soldiers gained military distinction and the friendship of Cromwell. He subsequently resided some years at the court of the Protector as agent of Massachusetts. On his return to America he held successively some of the most important civil and military offices in the gift of the colony, and finally in 1673 was elected governor. His administration is important in colonial history as the era of the war with King Philip, which his skill and energy were instrumental in conducting to a fortunate issue. Two years previous to his death he was knighted by Charles II in acknowledgment of his services to the New England colonies during this contest.

LEVERETT, John, grandson of Sir John Leverett (q.v.): b. Boston, 25 Aug. 1662; d. Cambridge, 3 May 1724. He was an eminent lawyer and judge, speaker of the colonial legislature and president of Harvard College from January 1707 until his death. He was a man of unusual attainments and received the honor, then rarely bestowed upon colonial subjects, of membership in the Royal Society.

LEVERRIER, lĕ-vă-rē-ā, **Urbain Jean Joseph,** French astronomer: b. Saint-Lô, 11 March 1811; d. Paris, 23 Sept. 1877. He was educated at the Collège Louis Le Grand and the Ecole Polytechnique, and devoting himself to astronomy, made observations which procured him admission to the Academy of Sciences in 1846. About this time he began investigating the perturbations of Uranus. He made calculations with the view of determining the mass and orbital elements of an unknown planet supposed to cause the disturbances and was able to assign within one degree the region where it might be looked for. John Couch Adams (q.v.), then a student at Cambridge, had been making investigations in the same track, and the honor of discovering Neptune (q.v.) is regarded as belonging equally to both. He received the grand cross of the Legion of Honor and other recognitions of his achievement. In 1854 Leverrier succeeded Arago as director of the Observatory of Paris, in which post, except an interval from 1870 to 1873, he remained until the end of his life. Here he distinguished himself by his thoroughness and system, reforming the management, getting rid of political barnacles and making it the equal of any observatory of its time. He was the originator of the planetary and solar tables that became standard in the *Nautical Almanac.* He spent many years elaborating Laplace's theories and in his ‘Mechanique Celeste’ presented to the astronomical world the best summary then extant on the planetary motions.

LEVI, lē'vī, one of the 12 patriarchs, a son of Jacob and Leah. The prince of the Shechemites having wronged his sister Dinah, he, with his brother Simeon, attacked their city and murdered all the males. Jacob reproaches them on his death-bed for this act of cruelty and foretells the dispersion of their descendants: «I will divide them in Jacob, and scatter them in Israel» (Gen. xlix, 7). Three sons went down with Levi to Egypt — Gershon, Kohath and Merari (Gen. xlvi, 2). Moses and Aaron were of this tribe. See Levites.

LEVI, lā-vē, **Sylvain,** French Oriental philologist: b. Paris, 28 March 1863. Professor in the College of France, director of the section of philology, history and religions, viewed from the scientific point of view. He was in charge of the course in Sanscrit in the same institution from 1889 to 1894; and he was sent on a special scientific mission to India and Japan (1897–98). He has written extensively for scientific publications and among his published works are 'Le Téâtre Indien' (1890); 'La Doctrine du sacrifice dans les Brahmanas' (1898); 'Le Népal' (1906–07).

LEVIATHAN (Hebrew) is compounded of two words meaning a *great fish* and *fastened;* hence it probably means a huge fish covered with close scales. The Septuagint renders it *drakōn* (a dragon), and *kētos* (a whale). From the description of it given in the book of Job (xli) it is usually, and probably correctly, considered to mean the crocodile, though in some places it has been interpreted the whale. See Tristram's 'Natural History of the Bible.'

LEVIATHAN, The. Hobbes' 'Leviathan' appeared in 1651 at the end of the civil war which left Cromwell in power. In many ways it was the child of these rebellious times, though it was not, as is sometimes charged, a defense of the Stuart monarchy. Far from being a mere political tract the 'Leviathan' stands as the first original treatise on politics and ethics since Aristotle.

Hobbes undertook the task of deducing a naturalistic theory of the state as an integral part of his naturalistic philosophy, an undertaking which marks him as the only English philosopher, with the exception of Spencer, who produced a *system* of philosophy.

The first part, «On Man,» may be said to lay the foundation of modern psychology. It proceeds from a discussion of elementary sensation to an analysis of the «interior beginnings of voluntary motions commonly called the passions,» whereby we may conceive the natural condition of mankind from which the state has been generated through the «laws of nature.» The political doctrine for which Hobbes is best known is briefly that man is by nature in a state of war where there exists no distinction of right and wrong. Such a state, however, is intolerable and reason directs that man give up his natural liberties for the sake of peace and security. Mankind accordingly transfer their natural rights to an absolute sovereign power whose decrees are the measure of justice and injustice. The inconvenience of such absolute rule is, for Hobbes, not to be compared with the evils of civil war. Not only civil custom but also divine worship are regulated by the sovereign though Hobbes himself laid the foundations of a philosophy of religion.

The fourth and last division of the book is a spirited attack on the Roman Catholic Church under the pleasing caption 'Of the Kingdom of Darkness' and brought the author into disfavor with the Royalists.

Hobbes considered himself the founder of social science and certainly the 'Leviathan' had a most potent influence in stimulating thought for a century and more. It attracted unusual attention during Hobbes' lifetime, even to the calling down of an investigation by Parliament.

There are no special treatises on the 'Leviathan' of any outstanding merit. The best general account of his philosophy in English is to be found in Sir Leslie Stephen's volume on 'Hobbes' in the English Men of Letters Series.

WALTER B. VEAZIE.

LEVIEN, lā-vĕn', **Ilse,** German authoress: b. Hamburg, 1852; d. 1908. After studying in her native city, she taught school for a number of years, until 1884. In that year she went to Stuttgart, where she studied æsthetics. There she became an intimate of Vischer, and after his death wrote 'Vischer — Erinnerungen' (1889). From Stuttgart she proceeded to Munich, attracted by the literary circle of which Paul Heyse was the leading figure. In her later years she was afflicted by an incurable illness which so depressed her that she agreed to be shot by her intimate friend, Emma Mandelbaum, who then killed herself. Miss Levien was married to an Armenian named Okunian. Of her novels those deserving mention are 'Hamburger Novellen' (1886); Zwischen Elbe und Alster' (1890); 'Bittersüss' (1891); 'Querköpfe' (1897); 'Erich Hetebrink' (1907). Other works are 'Gedichte,' a volume of poems (1890); 'Phibje Ohrtens Glück' (1902), a comedy; 'Die Retter der Moral,' a drama (1905).

LEVIN, Lewis Charles, American politician: b. Charleston, S. C., 10 Nov. 1808; d. Philadelphia, 14 March 1860. Removing to Woodville, Miss., he became a school teacher and subsequently followed the practice of law in various States, settling permanently in Philadelphia in 1838. The temperance cause attracted him and he edited a temperance organ. Becoming known as speaker and writer, he formed the Native-American party in 1843 and published *The Sun,* a daily paper, in its interests. As a representative of the party he was sent to Congress and served three terms (1845–51).

LEVIRATE MARRIAGE, among the Jews, the custom of a man's marrying the widow of a brother who died without issue. The same custom or law prevails in some parts of India. Consult Benziger, 'Hebraiche Archaologie' (1907).

LÉVIS, François Gaston, frāṅ-swä gäs-tôṅ lā-vē, DUC DE, French soldier in America: b. Château d'Anjac, Languedoc, 23 Aug. 1720; d. Languedoc, 1787. He served in the French army in various campaigns and in 1756 was ordered to Canada, where he became second in command to General Montcalm. For his services at the defense of Carillon in 1758 he was promoted major-general; and at Montmorenci in 1759 he repulsed the English under Wolfe. After Montcalm's death on the Plains of Abraham, Lévis took command of the French army, and during the winter of 1759–60 he maintained a vigorous struggle against great odds. He was victor at Sainte Foye in 1760 and might have gained Quebec if the French vessels had arrived at the opening of navigation in that spring. Lévis returned to France, where he continued in the service; he was made a marshal in 1783 and given a dukedom in 1784.

LEVIS, lā'vē or lĕv'ĭs, **LEVIS TOWN** or **PORT LEVI,** lē'vĭ, Canada, the capital of Levis County, Quebec, on the Saint Lawrence River, opposite Quebec city, with which it has ferry communication. It is an important port with government docks; is the landing place for transatlantic travelers; and has a large export trade. Most of the square timber brought down the Saint Lawrence in rafts is here loaded into sailing ships for Europe. It is on the Intercolonial railway and a terminus of the Quebec

Central and of branches of the Grand Trunk railways. It is fortified, has a convent, shipyard, factories, stores and lumber-mills. Pop. 7,452.

LEVITES, lē'vīts, those of the tribe of Levi who were not priests. They were the ministers specially singled out for the service of the sanctuary, and, with the priests, formed the sacerdotal tribe. After the idolatry of the golden calf, the Levites were the first to rally round Moses, and then the idea of a special consecration of «an Israel within an Israel» developed itself and the Levites thenceforth occupied a distinct position. They became guardians of the tabernacle and no others approached it under penalty of death. They appear to have been in part only descendants of Levi, others being taken into the tribe at convenience. From the first the Kohathites, as nearest of kin to the priests, had the highest offices assigned them. They bore the vessels of the sanctuary and the ark itself. A permanent arrangement was made for their maintenance. They were to receive the tithes of the produce of the land, and in their turn to offer a tithe to the priests. When the tabernacle should have a permanent place, the whole tribe was to be assigned 48 cities, six of which were to be cities of refuge. The Levites were moreover to preserve, transcribe and interpret the law and to read it every seventh year at the Feast of Tabernacles. They were not included in the general census of the people, but in a separate census (1 Chron. xxiii, 3); their number is given at 38,000. The vessels of the temple and sanctuaries were placed in their charge and they prepared animals for the sacrifices. Keeping watch and menial duties of cleaning the places of worship also fell to their share. They were the assistants and servants of the Aaronite priests, and at some periods seem to have closely approached the priests in dignity and position, and at others to be degraded and treated as menials. Their position was much changed by the revolt of the 10 tribes, and after the captivity, in the movement under Ezra, not more than 38 could be brought together. The purity of their blood was stringently guarded both by Ezra and Nehemiah. After the destruction of the temple in the dispersion, they disappeared from history, being merged in the crowd of captives scattered over the Roman world. See LEVITICUS.

LEVITICUS, Book of. Leviticus is the third book in the Old Testament. Its Hebrew name is *Wayyiḳrā*, «And he called,» after the opening word of the book. The designation *Leviticus*, which means «Levitical,» that is, «the Levitical System» — the Levitical system is found chiefly in this book — originated with the early Greek translation of the Old Testament known as the Septuagint and is meant to be descriptive of the contents. The Talmud suggests an even more appropriate title, namely, «Law of the Priests.»

Contents.— Leviticus contains few passages cast in narrative form; and in these few cases the narrative is introduced not so much for the purpose of describing the past as for the purpose of enforcing some provision for the future. The book is almost entirely a collection of laws, chiefly priestly or ceremonial in nature, that is, laws dealing with the functions and privileges of the priests and Levites; hence, the name Leviticus. The first group of laws (i, 1–vii, 38) deals with sacrifices and offerings — burnt offerings, meal offerings, peace offerings, sin offerings and guilt offerings — and with the priestly functions in connection with these sacrifices. These laws are followed by accounts of the consecration of Aaron and his sons as priests and of the sin of Nadab and Abihu, and by further regulations concerning priestly duties and portions (viii, 1–x, 20). Five chapters (xi–xv) are devoted to laws dealing with matters of cleanness and uncleanness. The day of the atonement is the subject of chapter xvi; chapters xvii–xxvi contain the so-called Law of Holiness (see further, section 4). Chapter xxvii is in the nature of an appendix, containing laws concerning vows, things devoted and tithes.

Composition.— Other books of the Pentateuch contain material taken from at least three originally separate sources, commonly designated by the letters J, E and P; in Deuteronomy appears a fourth source known as D. (For details see article PENTATEUCH). The whole of Leviticus is derived from P; but chapters xvii–xxvi, with the exception of some later interpolations found chiefly in chapters xxiii and xxv, formed originally a separate code of laws, which is designated «Law of Holiness» by modern scholars. (For a characterization of P see article PENTATEUCH, and the relevant sections in Eiselen, F. C., 'The Books of the Pentateuch'; a better understanding of the relation of Leviticus to the other P sections in the Pentateuch may be secured from a consecutive reading of the whole P document, as reproduced in an English translation in Kent, C. F., 'The Student's Old Testament'— for the material embodied in Leviticus consult especially the volume entitled 'Israel's Laws and Legal Precedents'— or in Brightman, E. S., 'The Sources of the Hexateuch'; compare also Carpenter and Battersby, 'The Hexateuch,' and Addis, W. E., 'The Documents of the Hexateuch').

The Law of Holiness.— Chapters xvii–xxvi constitute perhaps the most significant section of the book of Leviticus. Peculiarities of form, contents and expression have convinced modern scholars that these chapters existed at one time as an independent code. (It is not impossible that originally the code was more extensive than it is now. Some of its laws may have been omitted by the redactor who made it a part of P; others may have been transferred to other parts of the Pentateuch, for example, the food laws in Lev. xi and the law concerning fringes in Num. xv, 37–41). The designation «Law of Holiness» (H, the first letter of Holiness, as also of the corresponding German word «Heiligkeit,» is used as a convenient symbol), first suggested by Klostermann in 1877, finds justification in the fact that the central theme of the whole code is holiness, both moral and ceremonial. Its motto is, «Be ye holy, for I, Yahweh, am holy» (xix, 2; compare also xxii, 31–33).

As in the case of the Book of the Covenant (see article EXODUS), attempts have been made to subdivide the Law of Holiness into a series of decalogues (consult L. B. Paton, *Journal of Biblical Literature*, 1897, pp. 31–37), but such a theory necessitates a more or less radical rearrangement of the contents, which would find its only justification in the demands of the theory. The code deals with a variety of topics; it is worthy of note, however, that it lays much less stress upon civil and criminal than upon moral and ceremonial requirements. The more important subjects covered are the slaughter of animals and sacrifice (17); unchastity and Moloch worship (18); the religious and moral behavior of the Israelites (19); penalties for Moloch worship, unlawful marriage and other offenses (20); regulations touching priests and offerings (21, 22); sacred seasons (23); the lights of the sanctuary, the showbread, the blasphemer and his punishment (24); the Sabbatic year and the year of Jubilee (25). The code closes with a hortatory address, emphasizing the fundamental duty of loyalty to Yahweh (26).

The individual laws did not originate with the compiler of the code. Internal evidence makes it probable that the author of the code had access to earlier collections, which may have been made at different times and places and in different priestly circles, embodying laws handed down in oral or written form for generations and centuries. No doubt he may have formulated and inserted new laws, but, on the whole, his work was that of adapting older laws to present conditions, of bringing them into harmony with his own point of view, and of re-enforcing them by supplying suitable motives. Kent is undoubtedly right when, in speaking of these laws, he says, «Their roots are probably to be traced to the Mosaic and nomadic periods of Israelitish history.»

In language, thought and general aim the Law of Holiness resembles Ezekiel. For instance, the principle underlying the more formal teaching of Ezekiel is the same kind of holiness as is insisted upon in the Law of Holiness. The similarities are, indeed, so striking that some scholars have considered Ezekiel the author, or at least the redactor, of the code. However, there are also such obvious differences that it is practically impossible to believe that they came from one and the same author.

Are, then, the resemblances a matter of coincidence? Or, was Ezekiel influenced by the Law of Holiness? Or, was the compiler of the code influenced by the thought and language of Ezekiel? The evidence is so slight that there exists wide difference of opinion on these questions among scholars. On the whole, it seems most satisfactory to explain the resemblances by assuming that the Law of Holiness and the Book of Ezekiel originated in the same priestly circles and under the inspiration of the same religious conceptions and ideals. In the words of Kent, «It is probable, therefore, that the original draft of this code was made between the first and final captivity (B.C. 597–586), a period in which the more enlightened leaders, like Jeremiah and Ezekiel, saw clearly that the state was doomed and that Israel's laws and institutions, if they were to be preserved, must be put into written form.» This code served as a nucleus around which a later writer or compiler arranged legal material taken from various sources; the compilation which resulted is now known as P, or, the Priestly Code.

Bibliography.— In addition to the discussions named in the body of the article, attention may be called to the following books in English: Chapman, A. T., 'Introduction to the Pentateuch' (Cambridge 1911); and, in co-operation with A. W. Streane, 'Leviticus' ('Cambridge Bible,' Cambridge 1914); Cornill, C. H., 'Introduction' (London 1907); Creelman, H., 'Introduction' (New York 1917); Driver, S. R., 'Introduction' (1891); new ed., 1910); and in co-operation with H. A. White, 'Leviticus' ('Sacred Books of the Old Testament,' New York 1898); Gray, G. B., 'Introduction' (New York 1913); Harper, W. R., 'The Priestly Element in the Old Testament' (Chicago 1902); Kennedy, A. R. S., 'Leviticus and Numbers' ('New Century Bible,' Edinburgh 1911); McFadyen, J. E., 'Introduction' (New York 1905). Also articles on «Leviticus» in Hastings, 'Dictionary of the Bible,' 'Encyclopædia Biblica' and 'Encyclopedia Britannica' (11th ed.).

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LEVULOSE, a sugar ($C_6H_{12}O_6$) isomeric with a grade of glucose, but of left polarization; it always occurs with glucose in honey, in many fruits and in other sacchariferous vegetable tissues. It is popularly known as fruit sugar, is thick, sweet and will not readily crystallize. See SUGAR.

LEVY, Auguste Michel, French mineralogist: b. Paris, 1844; d. 1911. He was prominently connected with the geographical survey of France in 1876, and he was for many years a very active member of the Academy of Science. Among his publications which are all of a scientific nature are 'Structure des roches éruptives etudées au microscope' (1876); 'Synthèse des minéraux et des roches' (1888); 'Structures et classification des roches éruptives' (1889); 'Tableaux des minéraux des roches' (1888), with A. Lacroix as collaborator; and 'L'Explication de la carte géologique de la France,' in collaboration with F. Fouqué.

LÉVY, Emile, ā-mēl lā-vē, French painter: b. Paris, 20 Aug. 1826; d. Paris, 4 April 1900. He won the Grand Prix de Rome in 1854. In 1878 he was awarded a first class medal for a picture he exhibited in the Salon. He had received the cross of the Legion of Honor in 1867. He was much valued as a portrait painter, and also was successful in pastel. Among his works are 'The Death of Orpheus' (1866), now in the Luxembourg; 'Supper of the Martyrs' (1859); 'The Elements' in the Louvre; 'Presentation of the Virgin' in the church de la Trinité, and 'The Judgment of Midas.'

LEVY, le'vee, **Louis Edward,** American photo-chemist and inventor: b. at Stenowitz, Bohemia, 12 Oct. 1846. Coming to the United States in childhood he received his early education at the Detroit public schools. He gave special attention to mathematics and astronomy at the University of Michigan (1866) and to practical optics in Detroit (1861–70). He was connected with the United States Lake Survey (1866), made researches in microscopic photography (1867–70) and invented a process in photo-chemical engraving (1874) called the «Levytype.» He received (1896), with his brother Max, a medal for invention of «Levy line screen» and (1900) a gold medal for Levy «acid blast,» both from Franklin Institute, Philadelphia, and a medal and diploma from the World's Columbian Exposition (1893) for original discoveries. He has published and edited in. Philadelphia, *The Evening Herald* (1887–90); *The Mercury* (1887–91); author of 'The Jewish Year' (1895); 'The Russian Jewish Refugees in America' (1895); 'Business, Money and Credit' (1896), and, with Hugo Bilgram, 'The Cause of Business Depressions' (1914). He was elected vice-president of Inventors' Association at Paris in September 1900, member of Committee on Science and the Arts, Franklin Institute; elected vice-president of institute, 1916.

LEVY, Uriah Phillips, American naval officer: b. Philadelphia, 22 April 1792; d. New York, 22 March 1862. Sailing as a cabin boy before his 11th year, he was apprenticed as a sailor in 1804, and before he was 20 had passed through every grade and became master. On 23 Oct. 1812, he was commissioned sailing-master in the navy, serving until June 1813 on the ship *Alert* and then on the brig *Argus*. He was placed in command of one of the prizes which the *Argus* secured, but it was subsequently recaptured and he, with his crew, was imprisoned in England for 16 months. In March 1817, he was appointed lieutenant. Personal antagonism, in which religious prejudice played an important part, subjected him to nearly 40 years' struggle, in the course of which he fought a duel, killed his opponent, was court-martialed six times and finally dropped from the list as captain. He was finally restored to that rank in 1855, and later became commodore.

LEVY, lev'ĭ, (1) a term used in Europe for the compulsory raising of a body of troops from any specified class in the community for purposes of general defense or offense when the existing military forces are insufficient to meet the necessities of the case. When a country is in danger of instant invasion a *levée en masse* is sometimes made — that is, every man capable of bearing arms is required to contribute in person toward the common defense. On less urgent occasions the levy may be restricted to a class, as to men between 18 and 40 years of age. (2) In law, the seizure of property under a writ or other process; usually the taking by a sheriff or marshal of the property of a judgment debtor under an execution. It is not a valid levy unless the marshal or other official takes actual possession of the property. In the case of real property, he enters and takes charge, as by taking the key, or putting on new locks. In the case of chattels, he may either move them to another place or if they are cumbersome place a deputy to watch them. The judgment debtor is not always ejected from his premises, as they are taken subject to sale for the amount of the judgment, and any excess above judgment and costs belongs to the original owner. See ATTACHMENT; EXECUTION.

LEWES, lū'ĕs, **George Henry,** English philosophical writer: b. London, 18 April 1817; d. there, 30 Nov. 1878. He was in turn clerk, medical student and student of philosophy in Germany, whence he returned to England in 1840 to devote himself to general literature. His first important work was his 'Biographical History of Philosophy' (1846), of which a second edition appeared, much extended and altered. This work, written largely from a Positivist point of view, sufficiently proved his ability as a thinker and writer. He was literary editor of the *Leader* (1850–54). He published his 'Life of Robespierre' (1849) and a compendium of Comte's 'Philosophy of the Science' (1853). His 'Life of Goethe' (1855) won him a European reputation. From 1854 he was largely engaged in physiological investigations with special reference to philosophical problems. To this period belong his 'Seaside Studies' (1858); 'Physiology of Common Life' (1859–60), and 'Studies in Animal Life' (1862); 'Aristotle, a Chapter from the History of Science' (1864), was his last book before he became first editor of the *Fortnightly Review* (1865), from which, a year later, indifferent health compelled him to retire. His chief work, aiming at the systematic development of his philosophical views, is 'Problems of Life and Mind' (1873–79). Besides the works already mentioned he wrote 'The Spanish Drama: Lope de Vega and Calderon' (1847); two novels, 'Ranthorpe' (1847) and 'Rose, Blanche and Violet' (1848); and prepared various plays for the stage under the pseudonym of "Slingsby Laurence." Few writers have done as uniformly good work in so many fields and over so wide an area. In 1840 he married Agnes Jarvis, but the marriage was an unhappy one. In 1854 began his association with Mary Ann Evans (see ELIOT, GEORGE) and from that time they lived together as husband and wife. Whatever may be urged against the union on religious grounds, it cannot be doubted that it had a strong reciprocal influence on their lives and writings. Consult the *New Quarterly* for October 1879, and Cross' 'Life of George Eliot' (3 vols., London 1885).

LEWES, lū'ĭs, Del., town, in Sussex County, on Delaware Bay and on the Assowoman Canal and the Pennsylvania Railroad, about 40 miles southeast of Dover. The excellent harbor has been improved by an artificial breakwater. It is the shipping point for much of the farm and garden products of the southern part of Delaware. Large quantities of fruit, fish oils and vegetables are among the products shipped to Northern markets. Lewes is the headquarters of the Delaware Bay pilots. It contains a shirt factory, tomato canneries and tin-box factories. Cape Henlopen lighthouse, built in 1800, is nearby. The waterworks are municipally owned. Pop. 2,158.

LEWIS, lū'ĭs, **Agnes Smith,** English scholar and palæographist. She was educated at the Irvine Academy, Ayrshire, in her childhood and subsequently became an accomplished linguist, especially in modern Greek, Arabic and Syriac. She was married to Rev. S. S. Lewis (1836–91). Her remarkable services to palæographical science have been recognized by the bestowal upon her of honorary degrees from Halle, Saint Andrews, Heidelberg and Dublin. In company with her sister, Mrs. Margaret Dunlop Gibson (q.v.), she visited Sinai four times, and in 1892 discovered and photographed the Syro-Antiochene, or Sinaitic Palimpsest, the most ancient one of the four Gospels known. In 1896 they brought back the first half of the Hebrew Ecclesiasticus. Both sisters were awarded the gold medal of the Royal Asiatic Society in 1915. She has written also ‘Introduction to the Four Gospels from the Sinaitic Palimpsest’; ‘Some Pages of the Sinaitic Palimpsest Retranscribed’; ‘A Translation of the Syriac Gospels’; ‘The Palestinian Syriac Lectionary of the Gospels’; and other learned works on Scripture antiquities.

LEWIS, Alfred Henry, American journalist and author: b. Cleveland, 1858; d. 23 Dec. 1914. He was a lawyer by profession and at the age of 21 was elected city attorney of Cleveland. Later, he went West and in New Mexico and Arizona procured material for his Wolfville stories. He practised law in Kansas City for six years, entering journalism in 1890, and with William Nelson, editor of the *Star,* outlined the plans for the boulevard of the park in Kansas City. In 1891, Lewis went to Washington as a staff correspondent of the Kansas City *Times,* subsequently becoming Washington representative of the Chicago *Times* and later of the Hearst papers. He first gained prominence through his «Wolfville» tales of Western frontier towns. In 1898 he established in New York *The Verdict,* a humorous weekly. He has written ‘Wolfville’; ‘Episodes of Cowboy Life’; ‘Sandburrs’ (1900); ‘Wolfville Days’ (1902); ‘Wolfville Nights’ (1902); ‘Black Lion Inn’ (1903); ‘Peggy O'Neal’ (1903); ‘The Sunset Trail’ (1905); ‘Confessions of a Detective’ (1906); ‘Story of Paul Jones’ (1906); ‘The Throwback’ (1906); ‘When Men Grew Tall’ (1907); ‘An American Patrician — Aaron Burr’ (1908); ‘Wolfville Folks’ (1908); ‘The Apaches of New York’ (1912); ‘Faro Nell and her Friends’ (1913); ‘Nation — Famous New York Murders’ (1914).

LEWIS, Andrew, American soldier: b. Donegal, Ireland, about 1720; d. Bedford County, Va., 26 Sept. 1781. He resided in Augusta County, Va., where he was prominent in border conflicts; and in 1754 entered as a volunteer the expedition for taking possession of the Ohio region. Later he became a major in Washington's regiment of Virginians, and was at the surrender of Fort Necessity. In 1756 he was in command of the Sandy Hook expedition; in 1758 participated in that of Major Grant to Fort Duquesne, on which occasion he was taken prisoner and carried to Montreal. He was a commissioner of Virginia in 1768 to arrange a treaty with the Iroquois, in 1774 was appointed a brigadier-general during hostilities with the Indians on the western Virginia border, and 10 Oct. 1774 gained an important victory over the Shawnee confederacy at the battle of Point Pleasant (at the mouth of the Great Kanawha). He was a brigadier-general in the Continental army from 1 March 1776 to 15 April 1777, and then entered the Virginia civil service. He drove Lord Dunmore from Gwynn's Island, 9 July 1776. For several years he sat in the Virginia house of burgesses, and in the Virginia conventions of May and June 1775 was a delegate from Botetourt. As a soldier he was highly regarded by Washington. See Colonial Wars in America.

LEWIS, Charles Bertrand («M. Quad»), American journalist: b. Liverpool, Ohio, 15 Feb. 1842. He was educated at the Michigan Agricultural College, and served in the Union army during the Civil War. His journalistic work began on the staff of the Detroit *Free Press,* and he soon became known as a descriptive and humorous writer under the name of «M. Quad.» In addition to his work in this field, in connection with various publications, he has also written ‘Field, Fort and Fleet: A Sketch-Book of the Civil War’; ‘The Lime-Kiln Club’; ‘Sawed-off Sketches’; ‘Mr. and Mrs. Bowser’; ‘Quad's Odds,’ and several plays. Since 1902 Mr. Lewis has been connected with a newspaper syndicate, writing humorous sketches and stories. Many of his syndicate sketches have been translated into other languages and republished in the French, German and Japanese magazines and newspapers.

LEWIS, Charlton Thomas, American lawyer and author: b. West Chester, Pa., 25 Feb. 1834; d. Morristown, N. J., 26 May 1904. He was graduated at Yale in 1853, and after studying with a view to entering the ministry, served as professor at the State Normal University at Bloomington, Ill., 1856–57, and from 1858 to 1861 was professor in Troy University. In 1863–64 he was a United States deputy commissioner of internal revenue. He entered upon the practice of law in New York city in 1865; was associated with William Cullen Bryant in editing the *Evening Post;* and returned to law practice in 1871. At Harvard, Columbia and Cornell universities, during 1898–99, he was a lecturer on insurance. He was also president of the Prison Association of New York and of the State Charities Aid Association of New Jersey. Among his published works are ‘Gnomon of the New Testament,’ translated from the German of Bengel (1861); ‘History of Germany’ (1870); ‘Harper's Latin Dictionary,’ in collaboration with Charles Short (1879); ‘Latin Dictionary for Schools’ (1889); ‘Elementary Latin Dictionary’ (1890), etc.

LEWIS, Dio, American physician and author: b. Auburn, N. Y., 3 March 1823; d. Yonkers, N. Y., 21 May 1886. He studied at the Harvard Medical School, and practised for a time at Port Byron and at Buffalo, N. Y., publishing at Buffalo a monthly periodical with hygienic aims. He became widely known by his writing in advocacy of a system of higher gymnastics, and finally established a school in Boston in which teachers were trained in his new exercises; and a school for young ladies was also founded at Lexington, Mass., which was destroyed by fire in 1868. About 1883 he removed to New York. He wrote many articles for magazines, and his more extended works include ‘The New Gymnastics’ (1862); ‘Weak Lungs and How to Make them Strong’ (1863); ‘Talks About People's Stomachs’ (1870); ‘Our Girls’ (1871); ‘Chats with Young Women’ (1871); ‘Chastity’ (1872); ‘Gypsies’ (1881), and ‘In a Nutshell’ (1883).

LEWIS, Edmonia, American sculptor: b. New York, 4 July 1845. She is of negro and Indian parentage. With slight instruction in sculpture she developed a talent for that art, and came into notice in 1865 through the exhibition of her first known work, a bust of Col. Robert Gould Shaw, in Boston. That year she went to Rome to study, and there she soon afterward established permanent residence. Her works include ‘The Freedwoman’; ‘The

Death of Cleopatra’ (1876), exhibited at the Philadelphia Exposition; ‘The Marriage of Hiawatha’; ‘The Old Arrow-Maker and his Daughter’; ‘Asleep’; ‘Madonna with the Infant Christ,’ and many portrait busts, among them those of Lincoln, Longfellow, Sumner and John Brown. Most of her work is in Europe.

LEWIS, Estelle Anna Blanche (Robinson), American dramatist: b. near Baltimore, Md., April 1824; d. London, 24 Nov. 1880. While a schoolgirl she made a verse-rendering of the ‘Æneid’ into English; wrote ‘Forsaken’ and published ‘Records of the Heart’ (1844). Her best dramatic work, ‘Sappho of Lesbos’ (1868), a tragedy, ran through seven editions, was translated into modern Greek, and played at Athens. Edgar A. Poe spoke of her as the rival of Sappho; Lamartine called her the «female Petrarch.» Others of her works are ‘The Child of the Sea, and Other Poems’ (1848); ‘The Myths of the Minstrel’ (1852); ‘Poems’ (1866), and The King’s Stratagem’ (1869), a tragedy.

LEWIS, Francis, American patriot: b. Llandaff, Wales, March 1713; d. New York, 30 Dec. 1802. He entered commerce in London, but later came to America, and established a mercantile business in New York and Philadelphia. He made numerous successful business voyages to Europe, and in 1752 obtained the contract for clothing the British army in America. In the same year he was aide-de-camp to Gen. Hugh Mercer at Oswego, N. Y., when Montcalm advanced against it. After the capitulation, he was sent to France, and subsequently exchanged. For his services the government presented to him 5,000 acres of land. From 1765 he took part in public affairs. He was one of the New York committee in the First Colonial Congress (1765), in 1775 was elected to the First Continental Congress, in 1776 signed the Declaration of Independence, in 1777 was again elected to Congress and in 1779 became commissioner of the Board of Admiralty. He expended his wealth most freely in the patriot cause, to which his commercial knowledge also was very useful.

LEWIS, Sir **George Henry,** English lawyer: b. 1833; d. 7 Dec. 1911. He was educated at University College, London, and was called to the bar in 1856. He laid the foundations of his subsequent great reputation in the prosecution of the directors of Overend and Gurney’s Bank, and from that time he was employed in most of the great sensational trials, including the Colin Campbell divorce suit, the Tranby Croft baccarat scandal and the Piggott forgeries. So deeply was he cognizant of the unsavory secrets of the «upper ten» that it was said of him that he could have placed one-half of London society in jail; but in order that there might be no leakage of information, he kept no diaries in his professional work. He assisted the movement for the founding of the Court of Criminal Appeal, was knighted in 1893 and created a baronet in 1902.

LEWIS, Henry Carvill, American geologist: b. Philadelphia, 16 Nov. 1853; d. Manchester, England, 21 July 1888. He was graduated from the University of Pennsylvania in 1873, served as a volunteer in the State Geological Survey of Pennsylvania in 1879–84, was professor of mineralogy in the Academy of Natural Sciences of Philadelphia in 1880–88, and of geology at Haverford College in 1883–88. In 1886–87 he studied at Heidelberg, and in 1887–88 made special investigations regarding the origin of the diamond. He prepared a chart of the various ancient ice-sheets and glaciers of England, Ireland and Wales, for some time edited the mineralogical department of the *American Naturalist,* and wrote extensively on geological subjects, including ‘The Antiquity of Man in Eastern America, Geologically Considered’ (1880); ‘The Geology of Philadelphia’ (1883); ‘Comparative Studies upon the Glaciation of North America’ (1886), and ‘The Terminal Moraines of the Great Glaciers of England’ (1887).

LEWIS, James, American actor: b. Troy, N. Y., about 1840; d. West Hampton, Long Island, N. Y., 10 Sept. 1896. He first appeared in 1858 at the Troy Museum as Farmer Gammon in ‘The Writing on the Wall,’ played second comedy parts for a time at the Green Street Theatre of Albany, was later with a traveling company on the Georgia circuit, and was at Birmingham, Ala., when the Confederacy was proclaimed. Having escaped to the North, he afterward (1866) appeared at the Olympic, New York, as low comedian in ‘Your Life’s in Danger,’ presented by Mrs. John Wood’s company. He was afterward successful as Dick Swiveller, and from 1869 until his death he was leading comedian in Augustin Daly’s company. He took numerous parts with excellent versatility.

LEWIS, James Hamilton, American legislator: b. Danville, Va., 18 May 1866. He removed to Augusta, Ga., was educated at Houghton College and at the University of Virginia. He studied law at Savannah and was admitted to the bar in 1884. In 1886 he removed to Seattle, Wash., and there established a law practice. He was elected to the Territorial senate and in 1890 declined the nomination for Congress. He was candidate for governor in 1892, but was defeated. He was unsuccessful as candidate for the United States Senate in 1894. At the Democratic National Convention of 1896 he was the Washington State candidate for the vice-presidential nomination. He was elected to the 55th Congress (1897–99) as congressman-at-large. He was the author of a resolution for the recognition by the United States of the independence of Cuba. In 1900 he was again a candidate for the Vice-Presidency at the Democratic National Convention at Kansas City, being endorsed by the Pacific Coast States. He served on the staff of Gen. F. D. Grant in the Spanish-American War, in Cuba in 1898. In 1903 he was credited to the Joint High Commission on Canadian and Alaskan Boundaries at London and also served as United States commissioner to regulate the customs laws between the Dominion of Canada and northwestern United States. In 1903 he removed to Chicago and in 1905–07 was corporation counsel of that city. In 1908 he was Democratic candidate for governor of Illinois, but was defeated by Dincen. He was elected to the Senate of the United States in 1912 for the term 1913–19. He served as United States commissioner representing the United States Senate at London to execute treaty laws for safety at sea. He was chosen Democratic «whip» of the Senate and as such rendered efficient support to the Wilson administration. He has written ‹Handbook on Election Laws,› with A. H. Putney (1912); ‹Constitutions, Statutes and their Construction›; ‹Two Great Republics: Rome and the United States› (1913); ‹History of International Law.›

LEWIS, Matthew Gregory, called «Monk» Lewis, English author: b. London, 9 July 1775; d. at sea on the way from Jamaica to England, 14 May 1818. He was educated at Oxford, in 1794 became a member of the British embassy at The Hague, and in 1795 published ‹Ambrosia, or the Monk› (whence his sobriquet), which had a great success at the time. From 1796–1802 he represented Hindon, Wiltshire, in the Commons. Of his various dramatic works the best known is ‹The Castle Spectre,› first presented in 1798, and abounding in ghosts, storms and other melodramatic features. He visited, in 1815–16 and 1817–18, his property in the West Indies, to provide for the suitable treatment of his negro slaves; and published the ‹Journal of a West Indian Proprietor,› which is interesting as a description of the condition of the negro in Jamaica of that time. His writings had considerable influence on the early poetry of Walter Scott, for whose translation of ‹Götz von Berlichingen› he obtained the publication in 1799.

LEWIS, Meriwether, American explorer: b. near Charlottesville, Va., 18 Aug. 1774; d. near Nashville, Tenn., 8 Oct. 1809. He enlisted in the troops called out for suppression of the «Whisky Rebellion» in western Pennsylvania in 1794, entered the regular service in 1795 as lieutenant of the line, in 1797 was promoted captain, in 1801–03 was private secretary to Jefferson, and in the latter year was appointed commander of an expedition to cross the continent, with Capt. William Clark (q.v.) as second in command. On 5 July 1803 he left Washington for Pittsburgh, Pa., where the expedition was equipped; but he did not begin to ascend the Missouri until the ice had broken in the spring of 1804. Then he proceeded up the river to its sources, crossed to the Rocky Mountains, reached the headwaters of the Columbia River, floated down that river to the Pacific, and explored a large part of the Oregon region. He had covered in all more than 4,000 miles from the junction of the Missouri with the Mississippi. Having wintered in an entrenched camp on the south bank of the Columbia, he started eastward 23 March 1806, and arrived at Washington 14 Feb. 1807. He received a grant of land and was appointed governor of Louisiana, where he found much confusion, and where he was successful in restoring order. He was a bold explorer, and familiar with Indian matters. He died by his own hand near Nashville, Tenn. Consult memoir by Biddle and Allen (new ed., 1843), and Lighton, ‹Lewis and Clark› (1901; Riverside biography series). See also Lewis and Clark Expedition.

LEWIS, Morgan, American soldier and statesman: b. New York, 16 Oct. 1754; d. there, 7 April 1844. He was graduated from the College of New Jersey in 1773, studied law, in 1774 entered the Continental army, was commissioned major in the 2d New York, later became chief of staff to Gates with colonel's rank, and quartermaster-general of the northern army. He commanded at Crown Point; and after the war entered legal practice in New York. Elected to the assembly, he also became judge of the Court of Common Pleas, attorney-general of New York, succeeding Aaron Burr (1791), judge of the Supreme Court (1792), chief justice of the court (1793) and governor (1804–07). In 1805 and 1806 he was governor of the State of New York, winning from Burr by a large majority. In 1810 he was elected to the State senate, in 1812, after declining the portfolio of Secretary of War, became quartermaster-general of the armies of the United States, in 1813 was promoted major-general, and was in command at Sackett's Harbor and French Creek. He was president of the New York Historical Society, and president-general of the Cincinnati. In 1831 he was Grand Master of the Freemasons.

LEWIS, Tayler, American author and educator: b. Northumberland, N. Y., 27 March 1802; d. Schenectady, N. Y., 11 May 1877. He was graduated at Union College in 1820; studied law in Albany and practised at Fort Miller, but soon gave nearly all his time to the study of classical literature. In 1838 he was appointed professor of Greek at the University of New York, and in 1849 accepted the same professorship at Union College. He attained distinction as a philologist and in Christian apologetics. Besides contributing largely to periodicals, he published the following works: ‹The Nature and Ground of Punishment› (1844); ‹Plato contra Atheos› (1845); ‹The Six Days of Creation› (1855); ‹The Bible and Science› (1856); ‹The Divine Human in the Scriptures› (1860); ‹State Rights, a Photograph from the Ruins of Ancient Greece› (1864); and ‹The People of Africa, Their Character, Condition and Future Prospects,› with E. W. Blyden and Timothy Dwight (1871). He was a member of the Bible Revision Committee.

LEWIS, or LEWIS-WITH-HARRIS, Scotland, the largest and most northerly of the Outer Hebrides, separated from the mainland by the Minch, a sea 30 to 35 miles wide. The northern larger portion, Lewis, is in Ross-shire, and is separated by a narrow neck from the southern portion, Harris, which belongs to Inverness-shire. The island occupies 770 square miles, is 60 miles long, varies in breadth from 5 to 30 miles and has a diversified surface which attains an elevation of over 2,700 feet. It is almost totally devoid of trees, contains a good deal of peat bog, less than 4 per cent of the soil being under cultivation. There are interesting monumental remains, including what is regarded as the finest example of a Druidic stone circle in Scotland. Capital, Stornoway. Pop. of island about 34,319.

LEWIS AND CLARK EXPEDITION, The, in American history, a celebrated expedition to the northwestern part of the United States in 1803, under the command of Capt. Meriwether Lewis of Virginia and Capt. William Clark, the results of which gave a more definite idea of our natural resources in this hitherto unexplored region than had ever been known. Recognizing the importance of a thorough and accurate knowledge of the vast extent of the country acquired by the United States with their independence, Thomas Jefferson, while Minister to France, suggested to the traveler, Ledyard, an exploration of western America. Nothing came of it, however. In 1792 he made a similar proposition to the American Philosophical Society (q.v.), and Michaux, the celebrated traveler and botanist, proceeded as far as Kentucky, when he was recalled by the French Minister. In January 1803, in a confidential message to the Congress, President Jefferson recommended an appropriation for this purpose. It was granted, and he appointed Lewis, who had been his private secretary nearly two years, to the command of the expedition along with Clark. Lewis, while nominally in command of the expedition, always regarded Clark as his official equal, and during the three years of trying experience the two men worked hand in hand toward their great object with increased friendship and respect for each other. Lewis left Washington on 5 July 1803 and was joined by Clark at the Ohio. The expedition was delayed at Pittsburgh till 31 August, then proceeded on its way toward the Mississippi, Lewis choosing volunteers from the military posts along the way. The intention had been to winter at La Charette, a French settlement on the Missouri, but owing to the advanced season the first winter camp was pitched at River Dubois, on the Mississippi, about opposite the mouth of the Missouri. On 9 March 1804 Lewis was one of the witnesses to the transfer of Upper Louisiana at Saint Louis; on 14 May 1804 he set out from River Dubois on the long journey up the Missouri. The party comprised in addition to Lewis and Clark three sergeants, twenty-three soldiers, three interpreters and Clark's negro slave, York. Toward the end of October they reached the Mandan country and put up for winter quarters near the site of the present city of Bismarck, N. D., after a troublesome journey of 1,600 miles, battling against the swift current, the snags of the river and its falling banks. Much of this distance Lewis traveled on foot, hunting, collecting specimens and making notes upon the country. The journey was resumed 7 April 1805, and on the twenty-sixth the party reached the mouth of the Yellowstone, one or the other of the captains, usually Lewis, pushing ahead with hunters on foot to provide game for the camps and to examine the country. On 3 June they passed and named Maria's River, and on the thirteenth came to Great Falls. Nearly a month was spent in making the portage, and on 25 July the party came to the triple fork of the Missouri. Naming the three branches Jefferson, Madison and Gallatin, they proceeded up the Jefferson River, and on 12 August reached the head of navigation. Then marching across the Nez Percé trail, along the Bitter Root Mountains, came to the headwaters of the Clearwater branch of the Columbia. On 7 October they launched their canoes for the descent of this great river to the Pacific, which they reached 15 November. A fortified camp, called by the explorers Fort Clatsop, was pitched on the shore of Young's Bay, and here with much hardship the winter was spent. The return journey was begun 23 March 1806, and on 8 May the headwaters of the Clearwater were reached. On the return journey the party divided and explored a large part of the present State of Montana, uniting again below the mouth of the Yellowstone. Rapidly descending the Missouri they arrived at Saint Louis, 23 Sept. 1806. Both Lewis and Clark kept elaborate and valuable journals. Unfortunately they were never to edit them. A paraphrase by Nicholas Biddle, a friend of Jefferson, appeared in 1814 and has run through many editions. Not until 1903 were these priceless papers published in their complete form, presenting the first authentic record of this extraordinary expedition.

LEWIS OVERTHRUST, a large overthrust fault (q.v.) in the front ranges of the Rocky Mountains along the Canadian boundary. The break in the rocks is nearly horizontal, and old rocks of pre-Cambrian (q.v.) Age have been thrust horizontally out over younger rocks of Cretaceous Age for a distance of over five miles. The fault is well exposed in Glacier National park and vicinity, particularly on Chief Mountain, from which it is sometimes called the Chief Mountain Overthrust.

LEWISBURG, **lū'ĭs-bèrg, Pa., borough,** county-seat of Union County, on the Susquehanna River and on the Philadelphia and Reading and the Pennsylvania railroads, about 50 miles north of Harrisburg. It is on the border of the great anthracite coal fields and in a fertile agricultural valley. Its chief manufactures are flour, lumber, furniture, shirts, woolen goods, machine-shop products and acetylene gas. Its trade is chiefly in its manufactured products and in grain and vegetables. It is the seat of Bucknell University, opened in 1846 under the auspices of the Baptists. Pop. 3,081.

LEWISBURG, Battle of. On 21 May 1862 General Heth, with a Confederate force of three regiments of infantry, a battalion of dismounted men, a regiment of cavalry and three batteries, aggregating about 2,200 men, marched from Salt Sulphur Springs, Va., on Lewisburg, 24 miles distant, to surprise Col. George Crook who was encamped at that place with about 1,500 men. Heth marched through Union, crossed Greenbrier River, driving in Crook's pickets, and at 5 A.M. of the 23d formed line on a hill east of the town, Crook's camp being on the west side. Crook threw out a well-supported skirmish line, which soon engaged Heth's advance; Heth at first had some success, but was gradually forced back; Crook charged his main line; a panic seized Heth's troops and they fled from the field in disorder, retreating across the Greenbrier and burning the bridge behind them. Heth left on the field 38 dead and 66 wounded, 4 guns and over 200 stand of small arms. Over 100 of his unwounded men were captured. Crook's loss was 13 killed, 53 wounded and 7 missing. Consult 'Official Records' (Vol. XII); The Century Company's 'Battles and Leaders of the Civil War' (Vol. II).

LEWISHAM, England, a metropolitan and parliamentary borough of London, four miles southeast of Saint Paul's. Area, 7,014 acres. It is a favorite residential district and contains the great open common of Blackheath, which is replete with historical interest. There are large nurseries in the borough. The Horninian Museum is located on Forest Hill, and Morden's College, a 17th century foundation, on the south of Blackheath. The borough returns one member to Parliament. Pop. 160,834. Consult

Hasted, 'History of Kent and the Hundred of Blackheath.'

LEWISOHN, Adolph, American philanthropist: b. Hamburg, Germany, 27 May 1849. Coming to New York in 1865, where his elder brother, Leonard, merchant and philanthropist (b. Hamburg, 10 Oct. 1847; d. London, 5 March 1902), had preceded him a few years, the firm of Lewisohn Brothers was formed in 1866. In 1868 they specialized in metals, particularly copper, in which line they became leaders in the markets of the world. After his brother's death, Adolph Lewisohn headed prominent organizations in finance and metal industry and rapidly became identified with vital movements in philanthropy and social betterments, his character and services being recognized by his appointment on important national and local commissions. He gave $300,000 for the School of Mines building at Columbia University; also a German library and a stadium to the College of the City of New York; as president of the Hebrew Sheltering Guardian Society has been lavish in his gifts, and is a generous donor to all worthy causes.

LEWISTON, Me., the second city in size in the State, 35 miles north of Portland, on the east bank of the Androscoggin River, and on the line of the Maine Central and Grand Trunk railways; incorporated a town 18 Feb. 1795, with a population of 600; incorporated as a city 15 March 1861, with a population of 7,500, and organized 16 March 1863. This city is located in the heart of the Androscoggin Valley, a fertile and prosperous agricultural district. The city of Auburn, with a population of about 15,000, is located immediately opposite on the westerly bank of the river and the four cities are connected by four beautiful and commodious iron bridges, making them practically one community with a combined population of 41,311. The railroad connections and facilities are of the best. Three great lines of steam railways converge here,— the Maine Central, Grand Trunk and the Portland and Rumford Falls. The Maine Central runs west of Portland and the seaboard, there connecting by water routes with Boston, New York and all Southern ports, and by rail over the Boston and Maine with Boston, New York and all points south and west, and running east to Bangor, Saint John and the Maritime Provinces. The same road has local branches extending to Franklin and Somerset counties on the north, Augusta, the capital of the State, and the Kennebec Valley on the east, and again connecting with the seaboard on the south at Bath and Rockland. The Grand Trunk also extends from here westerly to Portland and northerly to Montreal, thence to Chicago and the far West. The Portland and Rumford Falls runs northerly through the beautiful Oxford region to Rumford Falls, thence into the heart of the celebrated Rangeley Lakes district, one of the finest fishing and game preserves in the country. Lewiston is the electric railroad centre of the State of Maine. The Lewiston, Augusta and Waterville Street Railway, one of the largest electric road systems in the State, radiates from this centre, extending southerly to the seacoast at Bath and easterly to Augusta and Waterville. The Portland-Lewiston Interurban Electric Railway runs from Lewiston to Portland and is generally recognized as one of the best equipped electric railroads in the country.

Manufactures.—Although located in a fertile agricultural district, Lewiston is distinctly a manufacturing city. The Androscoggin River here has a fall of 50 feet and furnishes one of the most extensive water powers in the country. This power is utilized by means of an immense system of distributing dams and canals. The amount of power at the falls is 13,000 horse power. About two and one-half miles up river an immense dam has been constructed which adds 10,000 horse power, making in all 23,000 horse power available for use; the latter 10,000 horse power is made available for use by electricity and is so distributed. The city's largest single industry is the manufacture of cotton cloth. Some of the largest manufacturing plants in the country are located here, and their various products are found in nearly all the markets of the world. Among them are the Bates Manufacturing Company, capital $1,200,000, operating 2,250 looms and 82,376 spindles; the Hill Manufacturing Company, capital $750,000, operating 1,912 looms and 80,016 spindles; the Androscoggin Mills, capital $1,000,000, operating 80,000 spindles and 2,206 looms; the Continental Mills, with 2,619 looms and 94,688 spindles; the Avon Mill with 126 looms and 6,160 spindles; the Libby and Dingley Company, capital $300,000, with 18,000 spindles. Their products are ginghams, bed spreads, fine dress goods, seersuckers, fancy shirtings and colored cottons, sheetings, twills, jeans, grain bags, drills, momie cloths, fine and coarse yarns, quilts, linen and cotton towelings, scarfs and table covers. There are three woolen mills located here — the Columbia Mills, operating 8 sets of machinery, 94 looms and a dye house; the Cowan Woolen Company, 8 sets of machinery, 46 looms and does it own dyeing; the Cumberland Mill, with 7 sets of machinery and 76 looms. The products of the woolen mills are blanket wrappers, cheviots, cassimeres, repellants and meltonettes. One of the largest and most noted bleacheries and dye works in the United States, the Lewiston Bleachery and Dye Works, is located here. Its capital is $300,000; its business, bleaching and dyeing cotton cloth.

In addition to the textile manufacturing industries there are other small industries, the products of which are machinery and mill supplies for cotton and woolen mills, engines, boilers, brick, lumber, carriages, clothing, foundry products and agricultural implements.

Banks.— There are two national banks, two savings banks and one trust and safe deposit company. The capital stock of the two national banks and the trust company is $675,000, surplus $286,830.46. The deposits in the savings banks and the trust company are $4,805,805.

Government and Finances.— The government is vested by charter in a mayor, board of aldermen and common council. The mayor is elected by the entire vote of the city, while one alderman and three councilmen are elected from each of the seven wards into which the city is divided. All are elected annually on the first Monday of March and hold their offices for the term of one year. The administrative offices are partly appointed by the mayor subject to confirmation by the board of aldermen and partly elected by the city council, the latter body being composed of the board of aldermen and common councilmen. The schools are under the jurisdiction of a superintending school committee of 14 members,— two elected by the voters of each ward and holding their offices for the term of two years. The public waterworks are under a board of water commissioners consisting of seven members, one elected annually in March by the city council under authority of a State law, and holding office for a term of six years. The mayor is ex officio a member of the board. The fire department is under the control of a board of commissioners consisting of five members, the mayor being a member ex officio. The board is created by a State law and one member is elected annually in March by the city council and holds office for a term of four years. The highways, bridges and sewers are under the control of a board of public works created by State law and consisting of seven members, of which the mayor is a member ex officio. One member is elected by the city council annually in February and the term of office is six years. The city owns its own waterworks. The supply is abundant, unusually pure and healthful and is taken from Lake Auburn, a beautiful and picturesque pond fed by springs and located in the city of Auburn, about four and one-half miles from Lewiston. This city was the first in the United States to own and operate its own street lighting plant. The undertaking has proved a great success and many other cities in the country have since adopted the plan. The total assessed valuation of real and personal property in 1915 was $18,907,701; rate of taxation $19.20 on each $1,000 of valuation; total municipal bonded debt $990,500; floating debt $221,396.

Churches and Charitable Institutions.— There are 12 churches in the city, some of which are imposing edifices. Four are Roman Catholic, one Episcopal, one Baptist, one Friends, one Congregational, two Free Baptist, two Methodist and one Universalist. There is also a Jewish synagogue. Two of the Catholic churches, Saint Joseph's and Saint Patrick's, are supported principally by Irish-American Catholics, while the third, Saint Peter's, is composed in membership of French-Canadian citizens who number about 13,000 people in this city. In connection with the Catholic churches are maintained four large Catholic parochial schools, with a total membership of 2,239 scholars. These schools are under the superintendence of the parish priests and are taught by the Sisters of Charity. Of the charitable institutions the more notable are the Sisters' Orphanage, the Healy Asyhum, the Young Women's Home, the Home for Aged Women. There are two hospitals in the city,— the Central Maine General Hospital and the hospital of the Sisters of Charity. Both receive substantial aid from the State. The Central Maine General Hospital is located in the heart of the city at the corner of Main and Hammond streets. The hospital of the Sisters of Charity is on Sabattus street, just at the edge of the thickly settled part of the city. Both hospitals are in elegant locations, and occupy imposing brick structures, commodious, well lighted and ventilated, with all modern appointments and improvements and high grade medical staff. The Sisters' hospital is in charge of the Sisters of Charity, but is absolutely nonsectarian, its doors being open to all alike.

Education.— The public school system of the city is of the best and a source of pride to its citizens. The city gives an absolutely free education to its pupils from the kindergarten to the completion of the high school course. Its school buildings are numerous, conveniently located, with all the usual modern appointments, some of the more recently constructed being among the best in the State. A new high school building was recently erected at a cost of $75,000. The total value of the school property owned by the city is over $300,000. The corps of teachers is selected with great care and a high standard of efficiency is required by the superintending school board. The results are highly satisfactory. In addition to the public schools are the Catholic parochial schools, where a high standard of thoroughness in instruction is maintained. Bates College is also located here. It is a coeducational institution and was the first college in New England to open its doors to women. The college is in a flourishing condition. It has 15 excellent buildings, a faculty of 19 full professors, one assistant professor, five graduate instructors, two directors of physical training and a dean for the women of the college with the standing of a professor and a student body of 472.

Miscellaneous.— The city has five excellent hotels, commodious, comfortable and well appointed; four fine theatres, a splendid public library, a beautiful city hall, a new United States post office building and a handsome public park, two live and ably conducted daily newspapers and one weekly, a progressive board of trade, and a population of thrifty, industrious, law-abiding and order-loving people. Pop. 26,247.

D. J. McGillicuddy.

LEWISTON, N. Y., village, in Niagara County, on the Niagara River, and on the New York Central and Hudson River Railroad, seven miles north of Niagara Falls, and about 25 miles north of Buffalo. It has communication by steamer with a large number of lake ports, and is the terminus of a line connecting with Toronto. The famous Gorge Route from Niagara Falls, traversed by an electric trolley line, connects at Lewiston by a suspension bridge with Queenstown. Canada, and other points of interest in the vicinity are the Devil's Hole and Bloody Run, Rumsay park, and the Tuscarora Indian Reservation. The place where Lewiston now stands was the site of an Indian village. In 1720 the French took possession of the place, and built a blockhouse, but abandoned it in a few years, when it was again occupied by the Indians. Joseph Brant's home was in this vicinity. On 14 Sept. 1763 occurred the Indian massacre at Bloody Run, a place near Lewiston. The first white settlement was made about 1800, and in 1818 the town was incorporated, and in 1843 the village. On 19 Dec. 1813, Lewiston was one of the towns burned by the English and Indians, in retaliation for the burning of Newark (now Niagara), Canada West, by the Irish-American General McClure; numbers of innocent persons perished on both sides. The place is now a favorite summer resort. There is a public library. Pop. about 713. Consult Pool, 'Landmarks of Niagara County' (Syracuse 1897).

LEWISTOWN, Ill., city, county-seat of Fulton County, on the Chicago, Burlington and Quincy and the Fulton County Narrow Gauge railroads, about 50 miles southwest of Peoria, and 60 miles north-northwest of Springfield, the State capital. It is situated in an agricultural region and is the trade centre of a large part of the county. Its chief manufactures are carriages and wagons, flour, lumber, brick, tile, furniture, bee traps, cigars, concrete blocks and dairy products. Livestock and farm products are shipped from Lewistown to the large markets. It contains a Carnegie library and owns the waterworks. Pop. 2,312.

LEWISTOWN, Mont., city and county-seat of Fergus County, 120 miles southeast of Great Falls, on the Chicago, Milwaukee and Saint Paul and the Great Northern railroads, and on Spring Creek. It is a manufacturing, mining, farming and stock-raising centre. It has flour mills, brick yards and creameries, a Carnegie library, Catholic hospital, four banks, city hall, courthouse, seven schools and a high school. Gold and coal are the principal objects of the mining interests. The waterworks are owned by the municipality. Because of its central location in the Great Judith Basin it is an important trade centre. The assessed valuation of its property is $3,283,000, while the estimated real valuation is $15,000,000. Pop. 6,500.

LEWISTOWN, Pa., borough, county-seat of Mifflin County, on the Juniata River, and on the Pennsylvania Railroad and on the Pennsylvania Canal, about 60 miles northwest of Harrisburg, the State capital. There is a hospital and a public library. It is situated in a fertile agricultural region in which are valuable mineral deposits, especially of iron and glass sand. Lewiston is a trade centre for an extensive farming section; but it is also a manufacturing borough. The chief manufactures are steel, iron, flour, leather, lumber, foundry and machine-shop products, silk, edge-tools, hosiery, hydrants and pumps. Lewistown and vicinity are now favorite summer resorts. Pop. 9,748.

LEXICOGRAPHY. See DICTIONARY.

LEXINGTON, Ky., city and county-seat of Fayette County, metropolis of the famous Blue Grass section, is on the Southern, the Chesapeake and Ohio, the Queen and Crescent and the Louisville and Nashville railroads, with 42 passenger trains daily, and is connected with five Blue Grass county seats by interurban railways with hourly service; is located at intersection of four national highways — Dixie, Jackson, Boone Way and Midland Trail; about 82 miles south of Cincinnati, Ohio, and about 22 miles southeast of Frankfort, the capital of the State; has a shopping population of 500,000 people within a radius of 50 miles; is the largest wholesale distributing centre in central and eastern Kentucky; is the gateway to the rich mining section of Kentucky. The first settlement was claimed by a party of hunters, who, in 1775, camped at this place and named it Lexington in honor of the battle of Lexington. They built a log cabin on the site so as to leave a proof of their ownership. Four years later Robert Patterson, one of the hunting party, made here a permanent settlement. Three years afterward the town was incorporated by the legislature of Virginia, as this section was then a part of Virginia. In 1792, when Kentucky became independent of Virginia, Lexington was made the capital of Kentucky, and the first Kentucky legislature met in this city. The city was granted a charter in 1832. Lexington is located in a fertile agricultural section; has the largest loose leaf tobacco market in the world, which is one of its largest assets, the sales amounting to about $5,000,000 annually; is surrounded by the finest and most celebrated stock farms in the world; has the fastest trotting track in the world; has more than $250,000 annual income from the training stables of the trotting and running tracks. Its chief manufactures are Bourbon whisky, harnesses, saddlery, flour, canned goods, lumber, carriages and wagons. Some of the important institutions are University of Kentucky, Sayre College, Hamilton College, Saint Catherine's Academy, State Agricultural and Mechanical College, Kentucky Reform School, Chandler Normal School (negro); 12 public schools. It has the Eastern State Hospital for the Insane, Saint Joseph's Hospital, Good Samaritan Hospital and Colored Industrial Home. It has an excellent public library. Henry Clay made this city his home from 1797 until his death. Pop. 41,500.

LEXINGTON, Mass., town, in Middlesex County, on the Boston and Maine Railroad, about 12 miles northwest of Boston. The town contains the villages of Lexington, East Lexington and North Lexington. Lexington was settled in 1642, was long known as «Cambridge Farms,» and was incorporated as a town in 1713. It was the scene of the first conflict between the colonists and the British troops in the Revolutionary War, on 19 April 1775. Lexington is situated in an agricultural region, and its industries are connected chiefly with the products of the farms and the trade necessary for supplying local wants, but is chiefly a residential town. It contains many points of interest, some of which are the first battle-ground of the Revolutionary War; the monument commemorative of this battle; the Monroe Tavern, built in 1695, which was Earl Percy's headquarters; the old Belfry, here was hung the bell giving the alarm that the British were coming, and the Hancock-Clarke house (1698), where Samuel Adams and Hancock lodged the night before the battle. The last-mentioned building is now used as a museum for Revolutionary and early settlement relics. The town has recently acquired and added to the battlefield, or «Common,» the Buckman tavern and three acres of land. This tavern was used as the Minutemen's headquarters 19 April 1775. A number of monuments in honor of the men and events which made Lexington famous adorn the city, also the first normal school built in America. It contains the Cary Library with nearly 25,000 volumes; a fine high school, the Hancock and Adams grammar schools, a town hall and a number of fine churches and elegant residences. The old burying ground, visited annually by hundreds of people, is mute witness of the noble people who have lived in this town. Pop. 5,500.

LEXINGTON, Mo., city, county-seat of Lafayette County, on the Missouri River, and on the Missouri Pacific and the Atchison, Topeka and Santa Fé railroads, about 63 miles southeast of Saint Joseph and 39 miles east of Kansas City. The first permanent settlement was in 1825, and it was incorporated in 1830. Lexington was the scene of a siege in 1861, when a Confederate force of 18,000 under Gen. Sterling Price attacked the city, which was defended by a Federal force of 3,000 men under Col. James Mulligan. The Federals surrendered on 20 Sept. 1861, but Price left the place a few days later, and put on guard a small force. On 16 October, a Federal force of 230 men under Maj. J. White entered the city, released the Union prisoners and took the Confederates captive. The city is in the midst of a fertile agricultural region, and is the largest single coal mining point in Missouri. Lexington is the seat of the Central College for Women, the Lexington College for Young Women and the Wentworth Military Academy. Pop. 5,242.

LEXINGTON, Va., town, county-seat of Rockbridge County, on the north fork of the James River, and on the Baltimore and Ohio and the Chesapeake and Ohio railroads, about 110 miles west by north from Richmond, and 44 miles northwest of Lynchburg. It is in a rich farming valley west of the Blue Ridge. Valuable deposits of sulphur ore are in the vicinity. The chief manufactures are dairy products, agricultural implements, flour and lumber. The city owns and operates the waterworks. The water is brought some distance from springs in the mountains. Lexington is the seat of the Virginia Military Institute, opened in 1839, and the Washington and Lee University (q.v.). Generals Jackson and Lee are buried here, and statues have been erected in their memory. The Jackson Memorial Hospital and Lee Memorial Church are also noteworthy. The mineral springs in the vicinity are becoming popular resorts; the Natural Bridge (q.v.), one of the natural curiosities of America, is about 15 miles south, separated from Lexington by low mountains or hills. Pop. 3,300.

LEXINGTON, Siege of. After the battle of Wilson's Creek (q.v.), Mo., 10 Aug. 1861, Gen. Sterling Price, abandoned by McCulloch and his troops, appealed to the secessionists of Missouri to fill his depleted ranks; and about the middle of August he moved northward toward the Missouri River, skirmished with a force under Gen. J. H. Lane, 7 September, at Dry Wood Creek, drove Lane out of the State, and followed as far as Fort Scott, which had been abandoned. On the 10th he was at Rose Hill, from where he marched for Warrensburg, which was reached on the 11th, Peabody's 13th Missouri at that place retreating to Lexington. When Fremont, at Saint Louis, heard of Price's northward movement, he ordered to Lexington a force which, when Price arrived at Warrensburg, numbered 2,800 men, with seven 6-pounder guns, under command of Col. James Mulligan, 23d Illinois. Mulligan took position and threw up entrenchments on College Hill, a bluff 200 feet above low-water mark, northeast of the city, overlooking it and the Missouri, and on which was a substantial brick building erected for a college. Immediately in front of the college was the first line of works, outside of which was a broad ditch, and beyond were «confusion» pits. On the morning of the 11th Price marched from Warrensburg toward Lexington, and that night, after a march of 30 miles, halted three miles from the city, where he rested until dawn, when he drove in Mulligan's pickets, and from four different points opened a cannonade upon the hastily constructed works around the college. After several sharp encounters the Confederates captured some outworks and drove Mulligan's men behind the main line. At the end of the day Price withdrew to the fair ground, two miles away, to await reinforcements and ammunition. Mulligan, looking for reinforcements, strengthened his position and prepared for a siege. Price was anxious because he knew of the approach of Union troops to relieve Lexington; but being reinforced to 25,000 men, and his ammunition coming up, he again moved on the city on the 18th, took possession, closed in upon Mulligan and began a siege. Rains' and Parsons' divisions occupied strong positions on the east, northeast and southwest of the works; Rives' division, supported by McBride's command and a part of Harris', moved along the river bank to a point immediately beneath Mulligan's works; fire was opened upon the Confederates from a dwelling on the bluff, 125 yards from the works; upon which the Confederates charged and took the house, and also the bluff immediately north of it. A gallant countercharge by Captain Gleason, with 80 men of the 23d Illinois, retook the house, but it was soon regained, and the adjoining heights fortified. Firing continued all day of the 19th; water gave out, but Mulligan encouraged his men to hold on until help arrived. On the morning of the 20th Price caused to be taken to the river heights a number of hemp-bales, with which movable breastworks were constructed. These were rolled forward; under cover of them the Confederates moved to within 10 rods of the works; and at 2 P.M., after over two days' continuous fighting, Mulligan's men being without water or rations and short of ammunition, a white flag was displayed, and Price ordered a cessation of firing. Mulligan had lost 42 killed and 108 wounded, and surrendered 1,624 men, 7 guns, many horses and a large amount of stores. Price reported a loss of 25 killed and 72 wounded. Price remained at Lexington until 30 September, when, pressed by the Union advance from Jefferson City, he abandoned the place and retreated toward Arkansas, leaving a guard of 500 men with the prisoners taken. On 16 October a squadron of cavalry under Maj. F. J. White surprised the party, captured 70 and released the prisoners. Consult 'Official Records' (Vol. III); The Century Company's 'Battles and Leaders of the Civil War' (Vol. I).

E. A. CARMAN.

LEXINGTON AND CONCORD, Battles of, in the American Revolution. Learning that the colonists had collected a quantity of military stores at Concord, Mass., Gen. Thomas Gage (q.v.), commander of the British troops at Boston, sent 800 troops under Lieut.-Col. Francis Smith and Maj. John Pitcairn (q.v.) to seize these stores. The colonists were warned of the expedition by William Dawes and Paul Revere (q.v.) and on their arrival at Lexington early on the morning of 19 April 1775 the British found about 70 minute-men under Capt. John Parker assembled to dispute their progress. Pitcairn ordered the provincials to disperse and, on their refusal, fired into them, then ordering the troops to open fire. The colonists returned the fire and retreated, leaving eight dead on the field. The British next proceeded to Concord, destroyed several pieces of cannon and some stores and prepared to retire to Boston. A body of colonists under Maj. John Buttrick offered resistance and firing was begun, resulting in a few casualties on both sides. The country having been aroused, armed men rushed to the scene so that the British were assailed from all sides.

Meanwhile, having been informed of the skirmish at Lexington and fearing disaster to his troops, Gage rushed 900 infantry under Lord Percy to Smith's aid. Being reinforced and provided with artillery the British were able to check the colonists, since the latter could not approach close, owing to the cannon fire. Nevertheless they continued to follow and harass the British until they had reached a point too close to the city for their own safety and accordingly abandoned the pursuit. Shortly after sunset the British reached Bunker Hill in a state of utter exhaustion. Though estimates of the colonists engaged vary from 250 to 20,000, probably not more than 400 or 500 were actually engaged at any one time. The British loss was 73 killed, 174 wounded and 26 prisoners; 49 Americans were killed, 39 were wounded and 5 were reported as missing. On hearing of the battles, thousands of colonists hastened toward Boston and soon that city was in a state of siege, culminating in the battle of Bunker Hill (q.v.), the regular investment of Boston, the occupation of Dorchester Heights (q.v.) and the subsequent evacuation of the city by the British. Consult Frothingham, Richard, 'The Siege of Boston'; Force, Peter, 'American Archives' (4th series, Vol. II); Lossing, B. J., 'Field-Book of the Revolution' (Vol. I, p. 523 et seq.); Heath, William, 'Memoirs'; Thacher, James, 'Military Journal'; Fisher, Sidney G., 'Struggle for American Independence' (Vol. I, pp. 300–308); Gage's 'Circumstantial Account' (in Mass. Hist. Coll., 2d series, Vol. II); accounts of the actions by Isaiah Thomas, Elias Phinney, Ezra Ripley and Lemuel Shattuck; and biographies of those engaged.

LEXOW, lĕk'sow, **Clarence,** American lawyer and politician: b. Brooklyn, N. Y., 16 Sept. 1852; d. 1910. He studied abroad and at the Columbia Law School, where he was graduated in 1872. He was admitted to the bar and established practice in New York city, receiving a large German-American patronage and engaging in many important litigations. In 1882 he became a resident of Nyack and was active in the Republican party there. In 1890 he was an unsuccessful nominee for Congress, but lowered the usual Democratic majority. In 1893 he was elected to the State senate where he served till 1898. Here he at once became a leader, was chairman of the committee on internal affairs and introduced the bi-partisan police bill calling for an investigation of the New York city police. This led to the appointment of the so-called "Lexow Committee," of which he was head; the investigations of this committee brought to light the system of protection of vice by the police in New York and were the direct cause of the reform campaign and the election of Mayor Strong. Lexow was also the introducer of the bill creating the city of Greater New York, was chairman of the joint legislative committee for the investigation of trusts and unlawful combinations, of the committee on primary elections reform and of the judiciary committee. In 1896 he was chairman of the committee on resolutions at the Republican State convention and introduced the gold standard plank in the platform; in 1900 he was a presidential elector. He is author of reports on 'Municipal Government' (5 vols., 1895) and on 'Trusts and Unlawful Combinations' (1895).

LEYDEN, lī'dĕn, or **LEIDEN,** Netherlands, an important town in the province of South Holland, 22 miles by rail southwest of Amsterdam, on both sides of the Old Rhine, which flows through the town by several branches. The neighborhood is marked by wind-mills, country-seats, pleasure-grounds, gardens and fertile meadows, and street railroads connect with the bathing resort of Katwyk, five miles to the northwest on the North Sea. The streets are straight, broad and clean; Broad street (*Breede-straat*) being esteemed one of the finest in Europe. In it is situated the town-hall (*Stadhuis*), originally founded toward the end of the 16th century, a picturesque building, with 30 windows in a line in front, a tall spire and three highly-ornamented projecting gables. In the council-chamber are the painting of the 'Last Judgment,' by Lucas van Leyden, and several good historical portraits; in part of the lower floor is situated the meat market. None of the churches are remarkable; the Reformed church of Saint Peter contains monuments to Boerhaave, Spanheim, Scaliger, etc. The most important educational institution is the university founded in 1575, formerly one of the most famed in Europe, especially for law, and still in excellent repute. It is attended by 1,500 students. Connected with the university are a well-laid-out botanic garden, an observatory, a library of 400,000 volumes, with over 3,000 maps and nearly 7,000 MSS., many of priceless value, an anatomical theatre and museum of comparative anatomy, one of the richest collections of natural history in existence, cabinet of coins, museum of antiquities and a rich Japanese museum. Leyden was noted for its cloth manufactures, which after 1670 declined, but have revived in recent years. There are also various other branches of manufacture and the former great trade in books, carried on in the latter part of the 17th and during the greater part of the 18th century and rendered world-renowned by the Elzevirs, is represented by several printing offices. There is an extensive trade in agricultural produce, especially cheese and butter. Pop. 59,207. The most memorable event in the history of Leyden is the successful siege it maintained against the Spaniards in 1573–74 until relieved by the action of the Prince of Orange in breaking down the dikes. Leyden is the birthplace of John of Leyden, the founder of the Anabaptists; Camper, Muschenbroeck, the brothers Gerard and Isaac Vossius, Gronovius, Rembrandt, Luke of Leyden, the brothers Van der Velde, Gerard Douw, etc. It is of interest to Americans as the asylum from 1609 to 1620 of the persecuted English nonconformists, the Pilgrim Fathers, founders of the New England States.

LEYDEN JAR. See Electricity.

LEYS, Henri Jean Auguste, ŏṅ-rē zhŏṅ ō-güst līs, or lā, Baron, Belgian painter: b. Antwerp, 18 Feb. 1815; d. there, 25 Aug. 1869. He worked from 1829 to 1832 in the studio of his brother-in-law, Ferdinand de Braekeleer, and in 1833 exhibited in Brussels ‘Fight Between a French Grenadier and a Cossack.’ He attracted still further attention by his picture ‘Fight of Burgundian and Flemish Soldiers.’ His style changed after his visit to Paris (1835); during which he confined himself to a study of the French Romantic school. Yet while the modern manner is discernible in his works, he shows himself also under the influence of Van Dyck and Rembrandt in such pictures as ‘Flemish Wedding’; ‘A Painter's Studio’; ‘A Family Party in Brittany’; ‘Burgomaster Six at Rubens' House,’ etc. In 1839 he still further modified his manner after traveling in Holland and familiarizing himself with the Dutch genre painters. It was certainly under their inspiration that he painted such pictures as ‘A Family Party’ (1845); ‘Divine Services in Holland’ (1850), etc. After completing his travels in Holland he still further changed his style and painted in the bizarre style of Quentin Matsys, whose naïveté and uncouthness he also reproduced. In 1863 he received a commission to decorate with frescoes the town-hall of Antwerp, and this he fulfilled by producing a fine series of scenes from the history of the city. He was also an etcher, lithographer and wood engraver of acknowledged skill. A statue to his memory was placed on the Boulevard Leys.

LEYTE, lā'tā, Philippines, a province consisting of the island of Leyte and 40 dependent islands, discovered by Magellan in 1521; area of Leyte 3,872 square miles; area dependent islands 342 square miles; total 4,214 square miles. Leyte lies southeast of Luzon, southwest of Samar, from which it is separated by the narrow strait of San Juanico, and northwest of Mindanao; it is roughly rectangular in outline; its extreme length from northwest to southeast is 121 miles. The two most important dependent islands are Biliran, area 144 square miles; and Panaón, area 76 square miles. They are both mountainous; Biliran is noted for its sulphur springs; Panaón is well populated and has some gold deposits. The interior of the island of Leyte is mountainous (highest peak, Mount Sacripante, 3,930 feet), there being a number of extinct volcanoes and the island is crossed by a number of large rivers; the coast line is irregular, indented by a number of bays, some of which afford excellent harbors, among the best in the Philippines. There are numerous roads on the east coast and the west coast is also paralleled by roads and trails for almost its entire length; the rivers furnish good inland transportation. The climate is temperate and healthy; the province is one of the best cultivated in the archipelago; the most important product is hemp and many of the plantations being under cultivation for almost 50 years require little work, the crop being abundant and of excellent quality; other products are rice for home use, cotton, chocolate, sugar, coffee and corn. The mineral products include sulphur, gold, iron, lead and silver; of these the most important is sulphur, which supplied the gunpowder works at Manila under Spanish rule. There are also valuable forests; the yield of dammar, the brea or pitch of the Spaniards, is the most important in the Philippines. The largest industries are the manufacture of abaca and the cabonegro or black boat cables from the hemp and the extracting of cocoanut oil. There are also ship-building yards at Tacloban, the capital, at which good-sized schooners are often built, and weaving of fine fabrics by the women. Civil government was established in April 1901; the people have proved generally favorably inclined to the new régime although there were sporadic troubles in 1905 and 1906; there has been renewed activity in every line of industry; and protection is now in the hands of a native police. The school attendances number over 44,000. Pop. 357,641, mostly Visayan.

LHASA, lhä'sä, or **LASSA,** läs'sä, Tibet, the capital of the country and the «Rome» or «Mecca» of Buddhism, its name signifying the «Place of God,» is picturesquely situated in a valley plain surrounded by mountains rising from the K-chu, a left affluent of the Sanpo or Upper Brahmaputra, about 280 miles in a direct line northeast of Darjiling. Access being exclusively forbidden to Europeans, three only having visited it during the 19th century, the place had a mysterious celebrity, until the British expedition under Col. G. J. Younghusband (q.v.) reached the city in 1904. The accounts since published corroborate the information previously obtained from Asiatic pilgrims and explorers. Broad roads lined by luxurious gardens lead past the well-built houses of the suburbs to the closely guarded gates of the walled city, which is dominated by the imposing Potala hill-palace and other hill-top edifices. The principal streets of the city are wide, regular and clean, lined with well-stocked stores and houses of two and three stories; but the side streets and lower parts of the town are very dirty and daily crowded by importunate beggars. The houses are generally two or three stories high, built of stone, brick or earth, terraced at the summit and uniformly whitened externally, the windows and door-frames being painted with the sacred or *lamanesque* colors, red and yellow. Internally, however, they are exceedingly dirty and comfortless and have no chimneys. A *yak* stable occupies the ground floor. There is no heavy traffic on the streets, *yak* and horse being the only means of conveyance. In the heart of the city is the convent of Moru, with a large printing establishment, from which numerous religious works are issued; and on the outskirts, toward the cardinal points, are four other large monasteries — Praebung on the west, Sera on the north, Khaldan on the east and Samie on the south or southeast side. All these have several thousand inmates, being greatly resorted to from China, Turkestan, Nepal, etc., as schools of philosophy and Buddhism. About 1½ miles northwest from the city and connected with it by two avenues of trees is the Potala, Bottala or Buddha-la, the residence of the Dalai or Talé (Grand) Lama, the ecclesiastical sovereign of Tibet and supreme pontiff of the vast regions forming central, eastern and southeastern Asia. A triple-peaked hill here rises abruptly out of the plain to the height of 367 feet; it is covered with convents and cells of monks and in the centre is the palace of the Dalai Lama, a fine edifice 1,000 feet long, four stories in height, with over 490 rooms and a large dome, which, like the columns of the peristyle surrounding the structure, is covered with gilding. The interior is full of idols, treasure and works of art. The chief public edifices are the Buddhist monasteries, some of them among the noblest specimens of architecture in Asia. The buildings were begun 1,200 years ago, the most recent parts being 200 years old. Seven miles to the west is the largest monastery of Tibet, the summer residence of the Dalai Lama. About 7,500 monks inhabit it, and it has room enough to accommodate the largest of American universities. Lhasa is the principal emporium of Tibet and a rendezvous of people from all parts of Asia; silk stuffs, tea and other articles being here exchanged for Tibetan, Indian and European goods. British troops under Colonel Younghusband occupied Lhasa in 1904, and after great difficulties concluded a treaty with the authorities in behalf of British interests. Pop. of city estimated at 10,000, exclusive of the great number of Buddhist lamas or priests and students in the monasteries (computed at 15,000). Associated with the Dalai Lama are two ambans, appointed every four years, who direct political administration, and the regent, who is the most learned lama in the country. Lhasa is the scene of a great annual religious gathering, attended by 80,000 lamas. The trade is entirely in the hands of women. As a great centre of pilgrimage, it is visited by great throngs from Tibet and Mongolia. (See Tibet). Consult Candler, 'The Unveiling of Lhasa' (London 1905); Chaan (a member of the Chinese mission of 1906–07), 'The Most Extraordinary City in the World' (in the *National Geographic Magazine* for October 1912); Holdich, T. H., 'Tibet the Mysterious' (New York 1906); Hac, 'Travels in Tartary, Tibet, etc.' (2 vols., London 1852); Landor, A. H. S., 'The Opening of Tibet' (ib. 1905); Millington, 'To Lhasa at Last' (ib. 1905); Waddell, L. A., 'Lhasa and Its Mysteries' (ib. 1905); Younghusband, F. E., 'India and Thibet' (ib. 1910).

L'HÔPITAL, Guillaume François Antoine, gē-yōm frän-swä än-twän lō-pē-täl, Marquis de Saint Mesme, French mathematician: b. Paris, 1661; d. 2 Feb. 1704. He devoted himself exclusively to the study of mathematics, having received some instructions from Jean Bernouilli in differential and integral calculus, and at the age of 32 distinguished himself by solving problems proposed to the lovers of mathematics by Jacques Bernouilli; and 1693 was admitted an honorary member of the Academy of Sciences at Paris. From that period he published, in the French and foreign journals, solutions of difficult questions, and other mathematical communications. Such was his reputation that Huygens, profound as was his acquaintance with science, applied to L'Hôpital for information relative to the nature of the differential calculus. This led to the publication of his 'Analyse des Infiniment Petits' (1696), the first French work on the subject of which a new edition was published by Lefevre (1781). Besides the work mentioned he was the author of 'Les Sections Coniques, les Lieux Géometriques, la Construction des Equationes' (1707), and 'Une Théorie des Courbes Mécaniques.'

L'HOPITAL, Michel de, mē-shĕl dė, French statesman: b. Aigueperse, Puy de Dôme, France, about 1504; d. Chateau Bellebat, near Etampes, France, 15 March 1573. He studied law in Italy, and returning to France was president of the Court of Accounts in 1554, and chancellor of France in 1560. To his moderate policy were due the Edict of Romorantin, 1560, which prevented the introduction of the Inquisition in France; the Edict of Pacifiction, 1562, authorizing the free exercise of Protestant worship; and the Ordinance of Moulines, 1566, which aimed at reform in the administration of justice. Distinguished for his integrity and moral courage, L'Hôpital stood far in advance of his time in his support of toleration and civil liberty. He gave up his office in 1568.

LI, lē, a Chinese unit, the $\frac{1}{1000}$th part of a liang or ounce, and the equivalent of «cash,» a copper coin of China, with a square hole in the middle, and an inscription on one side. The value of a li in American money is about one-eighth of one cent. Li is also a Chinese measure of length, the equivalent of one-one hundredth of a day's walk, very slightly exceeding one-third of an English mile on the level; but in a hilly country the li is a distance requiring the same effort to cover on foot as the li on the level, and in such a case it might be as little as an eighth of a mile.

LI HUNG CHANG, lē hoong chăng, Chinese statesman and diplomatist: b. Lu-chow, province of Ngan-hwei, 16 Feb. 1823 (or perhaps 1819); d. Peking, 7 Nov. 1901. He received a thorough education, passing through the successive grades of scholarship, with the severe examinations which in China must be undergone before admission to the literary caste, «ahead of 15,000 competitors.» In 1847 he received the third degree, and entered the Hanlin College in 1849. In 1850, when the Tai-ping rebels invaded Ngan-hwei, he joined Tseng Kuo Fan's army as secretary. He was appointed judge of Che-kiang province, and in 1861 governor of Kiang-su. In 1863, in conjunction with Col. (afterward Gen.) Charles George Gordon (q.v.), known as «Chinese Gordon,» he retook Su-chow and drove the rebels entirely out of Kiang-su. Gordon's force, the «Ever-victorious Army,» had previously been commanded by Frederick T. Ward, an American soldier of fortune, and was largely composed of foreigners. From them Li Hung Chang derived much information concerning Europeans, and also acquired increased military knowledge and ideas of Western political ethics.

For his services in suppressing the Tai-ping rebellion Li was made commander of the Imperial forces, head of the navy, a hereditary noble and received the highest decorations in the gift of the emperor. In 1864 he was appointed governor of the Kiang provinces. During the Nien-fei rebellion (1868) he was degraded for apathy in the face of the enemy, but was soon restored to favor. In 1872, after the massacres at Tien-tsin, followed by his stern measures of redress, he was appointed viceroy of Chi-li, the metropolitan province. During his long service in that office he resided at Tien-tsin, where he displayed his progressive designs by many improvements, among which were a great canal and the forming of the Chinese Merchants' Steam Navigation Company. Here for 24 years (1870–95) he exercised a power in reality second only to the emperor's, controlling the foreign policy of the empire, and introducing modern tendencies from Western civilization. He negotiated important treaties with Japan, Peru and other countries, increased the military strength of China in view of foreign encroachments, and may be said to have created the Chinese navy. He was imperial commissioner of trade for the northern ports; the emperor entrusted to him supreme charge of the military and naval forces sent to Korea in the Chino-Japanese War; and though several times disgraced, he bore nearly the whole burden of the war, marine and financial departments of the Chinese government. During the war with Japan the disasters to the Chinese armies and navy were laid to his charge, and he was degraded and punished, but still retained his office of Prime Minister. He was sent to Japan in 1895 to negotiate the peace treaty, and barely escaped assassination. Having represented China at the coronation of Nicholas II of Russia in 1896, he made a tour of the world, and was everywhere received as a highly distinguished guest. On his return he was again at the head of foreign affairs, and governor exclusively of the Kiang and Chi-li provinces. After the suppression of the Boxer risings of 1900–01 he played a prominent part in adjusting the relations of China with foreign powers.

The official integrity of Li Hung Chang has not gone unchallenged, although specific acts of corruption were never proved against him, but he amassed a huge fortune in the public service. Craftiness was conspicuous in his character and political acts; but however his conduct may have been inspired at different times, there is no question in regard to the great services which, through his extraordinary abilities and opportunities, he rendered to China and to the world. His shrewdness and thrift were shown in the curious fact that while acting so great a part in China for so many years he also held control of all the pawnshops in the empire. If he were «the buffer between China and the rest of the world» on the side of practical usefulness to his own country the scope of his work is seen in the influence which he exerted in behalf of modern progress; in the machine-shops which he established; the cotton-mills, fitted with foreign machinery; the bicycle factory that he built; the telegraph lines he constructed; the coal mines he opened; the arsenals he erected; the fortifications which he equipped with foreign guns; the modern firearms and military organization and instruction which he introduced; his gunboats and ironclads of foreign construction; railroads built under his direction; above all in the establishment of schools for the introduction of modern improvements and appliances; in the founding and endowment of a hospital, etc. These things showed in him a spirit and a purpose new to the official world in China, and from whose initiative still greater results may be expected. Consult Douglas, R. K., 'Li Hung Chang' (London 1895), and Mannix, W. F. ed., 'Memoirs of Li Hung Chang' (Boston 1913).

LIA-FAIL, or **STONE OF DESTINY,** a broad gray stone on which the kings of Scotland were crowned in the Abbey Church of Scone. In 1296 Edward I carried it to England and it still remains under the coronation chair in Westminster Abbey. Tradition says it is the stone which the patriarch Jacob used as a pillow.

LIABILITY INSURANCE. See INSURANCE, CASUALTY.

LIABILITY OF MUNICIPALITIES. See MUNICIPALITIES.

LIAKHOF ISLANDS. See NEW SIBERIA.

LIANAS, climbing and twining plants found in profusion in tropical climates, where they form thick, woody stems. In many instances they overtop the heads of the tallest trees, when they descend and interwine the entire forest by their cable-like shoots, frequently forming an impenetrable network or matting, which it is necessary to break through with the hatchet. The thickness of the stems of some of the species of lianas become so great that their constriction kills the tree to which they originally adhered, and when this has fallen the magnificent confusion of leaves and flowers presents one of the most striking features of those forest scenes. Vanilla, sarsaparilla and other medicinal plants are true lianas.

LIAS, *in geology,* a formation consisting of thick argillaceous and calcareous deposits, which constitute the base on which the Oölitic series reposes. It is generally regarded as the lowest division of the Jurassic system, and it rests on the Triassic system. The upper portion of these deposits, including about two-thirds of their total depth, consists of beds of blue marl, containing only a few irregular limestone beds. In the lower portion the limestone beds increase in frequency, and assume the peculiar aspect which characterizes the Lias, presenting a series of thin stony beds, separated by narrow argillaceous partings, so that the quarries of this rock at a distance assume a striped and ribbon-like appearance. The Lias is remarkable for the number and variety of its organic remains, among which are belemnites, ammonites, gryphites and other shells, together with the remains of saurian or lizard-like animals, of which the ichthyosaurus and pleiosaurus are familiar examples. The Lias crosses England from near Whitby, in Yorkshire, to Lyme, in Dorsetshire. In the Cleveland district the Lias contains workable beds of iron carbonate. See GEOLOGY.

LI HUNG CHANG

LIBANIUS, lĭ-bā'nĭ-ŭs, Greek sophist and rhetorician: b. Antioch, 314 A.D.; d. there, 395. He taught rhetoric at Constantinople, where his school drew such vast numbers of students that his rivals caused him to be expelled from the city as a sorcerer. He subsequently returned to Antioch, and there passed his latter days. He was highly esteemed by the emperors Julian, Valens and Theodosius. He was a pagan, but maintained friendly relations with many Christians, including Saint Basil and Saint Chrysostom, who were his pupils. He was a voluminous author, and several of his works are extant, but there is no complete edition of them. Consult Sievers, 'Das Leben des Libanius' (1868); Walden, 'The Universities of Ancient Greece' (1909).

LIBANUS, Mount. See LEBANON.

LIBATION. Among the ancients libation was properly a drink-offering; but was used also for other offerings to the gods, as a meal-cake, or something similar placed on the altar, and a part of which was burned. Libations were also made at domestic meals, some of the food being thrown into the fire on the hearth in honor of the Lares. A libation always accompanied the sacrifice offered in concluding a treaty with a foreign nation. The libations to the dead were not performed till the ninth day after the burning or interment, and consisted of milk, wine or blood, and generally concluded the funeral solemnities.

LIBAU, lē'bow, Russia, an important seaport in the government of Courland, on the Baltic, 14 miles by rail southwest of Riga, on a narrow strip of land between the sea and a small lagoon. It has rapidly increased in recent years and become an important centre of industry as well as of trade and is a favorite bathing resort. A great artificial ice-free harbor was built between 1893 and 1904, having 27 feet of water on the outer bar and it has also a naval harbor, and ship-building, especially of ocean-steamers, is carried on. An Orthodox Naval Cathedral was consecrated in 1903, and there is a school of navigation. It exports grain, linseed, flax, hemp, timber, rye and hides; and imports colonial produce, manufactured goods, herring, etc. Known as Lvra Portas in 1263, Libau has at different times been in the hands of Livonian and Teutonic orders, Prussia and Sweden, and came into possession of Russia in 1795. During the Great War, Libau was attacked by German naval forces on several occasions, and considerable damage was done. Pop. 90,400; 20 per cent of which are Jews.

LIBBEY, William, American scientist: b. Jersey City, N. J., 27 March 1855. He was graduated from Princeton in 1877 and from 1882 to 1883 was assistant professor of physical geography there. From 1883 to 1898 he was professor of histology, and since 1883 professor of physical geography and director of the museum of geology and archæology at Princeton. He is a Fellow of the geographical and geological societies of London and Paris. He is author, with Dr. Franklin E. Hoskins, of 'Jordan Valley and Petra' (1905).

LIBBY PRISON, a famous prison at Richmond, Va., during the Civil War. It was a large brick structure named for its owner, who used the building as a ship chandlery and also as a tobacco warehouse before the war. The Confederate government early secured it as a military prison for Federal soldiers, and many thousands were confined here. It was divided into large rooms or lofts about 100 by 45 feet, and was inadequate for the housing of 1,200 prisoners, which at times was the total. There were ventilation and bathing conveniences of a sort, but no heating, and the food was often poor and inadequate. On 9 Feb. 1864 there was a large delivery of the prisoners, 109 escaping through a tunnel that they had laboriously dug with their hands and bits of board. Col. Thomas E. Rose led the refugees and 59 of them ultimately reached the Federal lines, 48 being recaptured and two drowned. There were other escapes at times. The unsanitary conditions resulted in a very heavy mortality, and many of the poor sufferers welcomed death. In 1889, the building was torn down and removed, brick by brick, to Chicago, and set up there as a museum, but the enterprise proved a failure.

LIBEL, (1) a defamation of a person, with malice expressed or implied, made public by means of writing, printing or pictures, calculated to provoke him to anger, or expose him to hatred, ridicule or contempt. Spoken words, however opprobrious or injurious, do not amount to libel but are classed as slander; and, being more limited in their publicity, the offense is not so great as in a case of libel. There may be a libel by traducing the memory of one who is dead, as well as one which attacks the reputation of one who is living. Any publication which has a tendency to disturb the public peace or good order of society is actionable as a libel, and may usually be prosecuted by either a civil action for damages or by a criminal proceeding, and both remedies are often pursued at the same time. In the absence of some statutory provision on the subject, proof of the truth of the matter contained in the libel does not ordinarily furnish a good defense to the offending party. The publication may be very limited and yet amount to the offense. The malicious reading of a libel to one or more persons has been held sufficient and the sale of each copy of a book containing a libel has been pronounced by a court as sufficient to furnish a distinct offense. Libels against the government consist of calumnious publications in denunciation or unwarrantable criticism of the established governmental system or in censure of methods of administration, provided the allegations are of such a nature that their natural tendency or evident purpose is to promote disaffection among the citizens or to excite a spirit of revolution. But indictments for libels of this character are very rare, and would not be resorted to except in extreme and very plain cases. Many of the States have enacted statutes upon the subject of libels, declaratory of the old common-law rules, with ancillary provisions, relating principally to forms of administration, with provisions as to punishment. A libel may be a misdemeanor only, or a felony, according to the character of the offense.

(2) Libel in admiralty practice denotes the complaint or pleadings by which an action is commenced, to enforce some claim or right in a marine matter, and contains a circumstantial

statement of the claim. The general scope of the jurisdiction of admiralty embraces all marine contracts and maritime torts, including captures in times of war, and seizures for revenue forfeitures, and all duties appertaining to marine commerce and general navigation. The test of jurisdiction in torts is determined by the place where the same were committed. Such a libel is not required to be drawn with any degree of technicality, the substance being more important than the form. In the United States substantially all admiralty matters are transacted in the Federal courts. The plaintiff, or moving party in an admiralty proceeding, is called the libellant, and the defendant, or party against whom the proceeding is brought, is termed the libelee or respondent. Sometimes a libel is directed *in rem* or against property only, without naming a respondent. Consult Bigelow, ‘The Law of Torts’ (7th ed., Boston 1901); Newell, ‘The Law of Libel and Slander in Civil and Criminal Cases’ (2d ed., Chicago 1898); Odgers, ‘A Digest of the Law of Libel and Slander’ (4th ed., New York 1905); Pollock, ‘The Law of Torts’ (7th ed., New York 1904); Townshend, ‘Treatise on the Wrongs Called Slander and Libel’ (4th ed., New York 1890).

LIBERAL PARTY, in politics, the party which claims to be distinctively that of reform and progress with a view to increased political power of the people, and to extending privileges to the masses. Most European countries have a Liberal party, but in several of them, such as Germany, Belgium and France, liberalism has lost heavily owing to the rapid spread of Socialist doctrines, which involve economic and industrial rather than political reform. In Great Britain, Liberal and Conservative ministries follow each other at irregular intervals, and on the whole the system has worked well. The greatest of modern Liberal leaders was Gladstone, but his introduction, in 1886, of the Irish Home Rule and Land Purchase bills alienated many of his supporters, and led to the formation of the Liberal Unionist party. On the question of the war policy in South Africa in 1899–1901 the Liberal opposition was split into several groups, such as the Liberal Imperialists, who supported the government; the so-called «pro-Boer» Liberals, who opposed the war throughout; and those who tried to combine both policies.

LIBERAL REPUBLICAN PARTY, in American politics, a party organized in 1872 by Republicans, who were dissatisfied with General Grant's first administration as President. At a convention held by them in Cincinnati, in that year, Carl Schurz was elected its president, and a platform adopted demanding civil service reform, local self-government and universal amnesty, recognizing the equality of all men, recommending the resumption of specie payment, etc. Horace Greeley and B. Gratz Brown were named for President and Vice-President. This platform and these nominations were adopted by the regular Democratic convention of that year, but dissensions arose, and other candidates were nominated, the result being that the Republican nominee, General Grant, was elected by an overwhelming majority and the Liberal Republican party was thereafter practically dead. The real strength of the party lay in its presidential candidate, Horace Greeley, who had a large following, particularly of the farming element throughout the country, which was secured through the large and widespread circulation of the New York *Weekly Tribune*, of which Greeley was the editor. Among those connected with the party were Charles Francis Adams, Lyman Trumbull, David Davis, Horace White and David A. Wells. Consult Fess, S. D., ‘History of Political Theory and Party Organization in the United States’ (Boston 1910); Hart, A. B., ‘Cyclopedia of American Government’ (New York 1914); Woodburn, J. A., ‘Political Parties in the United States’ (ib. 1903); Dunning, W. A., ‘Reconstruction’ (ib. 1907); Rhodes, J. F., ‘History of the United States’ (1906).

LIBERAL UNIONIST PARTY, in British politics, a party formed in 1886 by the Liberals under the leadership of the Marquis of Hartington who objected to Gladstone's Irish Government and Land Purchase bills, as being dangerous to the empire. They gained their immediate object by coalescing with the Conservatives, and in the election which followed the defeat of the Gladstonian ministry they succeeded in returning some 80 members to Parliament. They have since acted with the Conservatives.

LIBERATOR, The. See GARRISON, WILLIAM LLOYD.

LIBERIA, a republic on the west coast of Africa; the only part of the continent remaining in Negro hands and under Negro control. Situated in what was formerly known as Upper Guinea, it extends for some 350 miles along the coast, from Mano River on the west to the Cavalla River on the east. It is between long. 7° 33′ and 11° 32′ W. and lat. 4° 22′ and 8° 50′ N. Its area is approximately 43,000 square miles, a little more than that of the State of Ohio. It is bounded on the west by the British colony of Sierra Leone and on the north and east by French possessions. The coast is low, through most of its length a narrow sandy beach, interrupted at only three points by elevations. Five-sixths of the area of Liberia is covered with dense tropical forest; there are mountains in the interior of the east half; the Mandingo Plateau in the northwest is grassland. There are no good harbors. There are more than 30 rivers, most of which have no navigation value; the Saint Paul with the Mesurado is navigable to White Plains, a distance of 20 miles, and the Cavalla is practicable for boats of some size for about 80 miles. The climate of Liberia is tropical with a short dry season from December to February, inclusive, and a cooler wet season; on the Mandingo Plateau the dry season extends from November to May. Liberia was acquired by the American Colonization Society, founded in 1817, for the purpose of colonizing free blacks from the United States. The first company of colonists was sent out in February 1820 on the *Elizabeth*. During the next 25 years 4,500 more colonists were sent over by the society and auxiliary organizations. The government of the United States was favorable to the enterprise and at times gave active assistance. While the colonists suffered severely from the climate and at times had difficulty with the natives, they made a number of settlements on the coast and on the lower reaches of some of the rivers. The name Liberia was officially adopted in 1824 and at the same time the name of the chief settlement was changed to Monrovia. The names were suggested by Colonel Harper of Maryland who was prominent in the work of the society. Liberia referred to the free status of the colonists, Monrovia honored the then President of the United States, James Monroe. At first under an agent, later under a governor appointed by the society, the settlers developed a practical governmental organization and, in 1838, adopted the official title «Commonwealth of Liberia.» To secure the funds for administration, duties and port-dues were instituted. These led to trouble with the British government which could not recognize sovereign powers in «a mere commercial experiment of a philanthropic society.» Consequently it was decided best that the relation between the colony and the society should cease. A declaration of independence and a constitution were adopted on 26 July 1847 and the republic of Liberia came into existence. The first President was Joseph J. Roberts, himself a colonist, who was the last governor under the society. The new nation was promptly recognized by Great Britain (1848) and France (1852); other nations made recognition during the next few years; the United States did so in 1862, Abraham Lincoln being President. At first the term of Liberia's President was two years, but it has been extended to four. President and Vice-President are elected; there are two legislative bodies: House of Representatives and Senate; the Supreme Court consists of three justices; the Cabinet includes seven members, heads of departments of State, Treasury, Justice, War and Navy, Interior, Post Office and Public Instruction. The franchise is confined to males, of at least 21 years of age, owners of real property. Only persons of negro blood may be citizens. The population of Liberia is uncertain: it is made up of three quite distinct classes — Americo-Liberians in the settlements, coast natives who come into contact with the Liberian government and with traders and other Europeans, and the natives of the interior; there are perhaps 20,000, 60,000 and 1,500,000 respectively. These figures are, however, crude estimates to which little weight can be attached. Up to the present, the Liberian settlements have been almost exclusively occupied in trade; agriculture has been little developed and there is practically no manufacturing. The country is rich in natural resources. Palm oil, palm nuts, piassava fibre and rubber are the leading exports. Liberian coffee once had a good market, but has lost its importance. Fine woods and gums will be in course of time a source of wealth. Plantations of rubber and coffee and mines of gold are under development, chiefly by British and German enterprise. Liberia has had boundary troubles with both of her neighbors and has already lost territory to both Great Britain and France. Difficulties came to a head about 1908, when she sent a commission to the United States appealing for aid. A commission of investigation was appointed by our government which visited Liberia and made certain specific recommendations. As a result, the United States has aided Liberia in straightening out her financial affairs and in strengthening her internal condition. In connection with these adjustments, the customs service of the republic is temporarily administered by an international commission with an American at its head. With firm backing from the United States, Liberia might not only prosper, she might become the leader of Africa. During the embroglio of the World War (1914–18) Liberia severed diplomatic relations with Germany on 8 May 1917 and formally declared war on 4 August. On 10 April 1918 a German submarine bombarded Monrovia, the capital of Liberia, destroyed the wireless telegraph station and sank the Liberian armed vessel *President Grant*. Ten persons were killed. The submarine was later sunk by a British cruiser. Liberia's contribution to the war consisted mainly in sending some hundreds of laborers to France. In November 1918 it was announced that the negro republic desired a voice in the peace conference and that the principle of self-determination should be applied to the natives of African colonies, not only those taken from Germany, but also former parts of Liberia which had been absorbed by France and Great Britain.

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LIBERIUS, Pope: b. Rome; d. there, 24 Sept. 366. He was Pope from 352 to 366; is one of the pontiffs that have incurred the accusation of heresy. It is conceded that he suffered an exile of two years by order of the Emperor Constantius II for refusing to subscribe to a condemnation, by the Council of Arles (354), of the great champion of the Niceno-Constantinopolitan creed of the homoousian, Saint Athanasius. But it is alleged that he obtained his recall by subscribing to a heretical, formally Arian confession of faith drawn up by an assembly of bishops at Sirmium. Constantius II died in 361 and Liberius was then more free and annulled the decrees of the Council of Rimini, but was not severe upon the bishops who had signed them. He renewed relations with Athanasius and Hilarius, received deputies from the Eastern Episcopate and gave the communion to many of the Arians.

LIBERTAD, lē-bĕr-tăd', Peru, a maritime department bordering on the Pacific Ocean, with the departments of Lambayeque, Cajamarca and Amazonas on the north, Loreto on the east and Ancachs on the south. It is mountainous, with a narrow strip of level land along the coast. The Marañon, the head stream of the Amazon, waters its eastern slopes. Many of the eastern valleys are very fertile. Agriculture and stock-raising are carried on. Mining is in a backward state, although considerable mineral deposits are said to exist in the mountains. Area, 10,206 square miles; pop. about 250,000. Capital, Trujillo.

LIBERTAS, the goddess of freedom. By the Greeks she was invoked by the synonymous title Eleutheria. At Rome, her most famous temple was situated on the Aventine Mount. She was represented by the figure of a woman holding in one hand a cap, the symbol of liberty, and two poniards in the other.

LIBERTINES, a name that has been given to various liberal organizations: (1) a sect of fanatics in the 16th century in the Netherlands and Belgium, who maintained that nothing is sinful but to those who think it sinful and that perfect innocence is to live without doubt. They advocated community of goods and gave themselves the name of «Spirituals»; (2) a faction of the Hellenistic Jews who attacked Stephen, as told in Acts vi, 9; (3) the Liberal party in Geneva that opposed Calvin; (4) the early Anabaptists. The use of the term did not often imply loose morals and many think the Libertine Jews of the time of Christ were more properly called Libystines or Libyans, after Libya in Africa.

LIBERTY, Mo., city, county-seat of Clay County, on the Chicago, Rock Island and Pacific, the Chicago, Burlington and Quincy and other railroads, about 15 miles, by rail, northeast of Kansas City. It is situated in an agricultural region and its chief manufactures are flour, dairy products and vacuum cleaners. Its trade is principally in grain, vegetables, fruit and live-stock. It is the seat of the William Jewell College, opened in 1849 under the auspices of the Baptists, and of the Liberty Ladies' College opened in 1899 and contains a Carnegie library and an Odd Fellows' Home. The waterworks are the property of the municipality. Pop. 2,980.

LIBERTY, EQUALITY, FRATERNITY, a well-known motto of the French Republic, dating from the time of the first revolution. Equality, in this connection, means equality before the law and the absence of class privileges. The motto gives title to a work by Sir J. F. Stephens (1873).

LIBERTY, Religious. Religious liberty is the right or freedom of a person to worship or not to worship according to his own understanding and preferences, and, within the requirements of public order, of teaching his religious beliefs without hindrance or molestation; the complete equality of all religions before the law.

The question of religious liberty seems never to have arisen in pre-Christian times. The story of Paul's visit to Athens and the noted Pantheon at Rome seem to reveal a tolerant attitude of the ancient peoples toward all religions. All persons within the state might, as a matter of political necessity, be required to pay formal homage to the god of the state, but they were also wholly free to worship their own particular gods. This ancient toleration carried, however, the seeds of its own destruction within itself. For while it was allowed to people to worship what gods they pleased, it was rigidly required of them, regardless of what their personal faiths might be, to take part in the state religion. Naturally to persons who believed that there was and could be but one God, one religion, one worship, and that to take part in any other worship was exceedingly sinful, such a demand would become intolerable. While appearing to be tolerant it actually forced a person to go against his own conscience and to do what he believed to be hateful to God. When religion became more a personal than a state affair there grew up a bitter resentment against any sort of power that sought to compel a person to go against his conscience and against his God. The truthfulness or actual value of a person's religion is no part of the question. It is enough that there has sprung up from the deepest depths of the human heart and mind an unalterable and unconquerable opposition to any authority that seeks to force a man to worship in a way alien to his faith.

The problem is much less simple than this seems to imply. It is hardly more than a century ago that it was finally conceded by the governing power that religion is not a state but a purely personal affair. Even at the present time this is not conceded in all countries. From time immemorial the state has had its religion as by law established, the idea being that the safety and welfare of the state depended upon the proper performance of the state religion. To protest and refuse to perform these religious rites was to become a disorderly and possibly a revolutionary element within the state. Thus the issue was joined, those in control of the government insisting that the public order and safety required all to worship according to the established religion and in no other way and in opposition to these an increasing number demanding as a matter of divine right the freedom to worship according to the dictates of their own conscience. Something more than that is involved — and this is the most serious part of the trouble; the right of a person not only to worship but to teach, propagate the doctrine he believes true, so that others may be led to worship in his way. This, under the old system of state religion, plainly amounted to nothing less than the right to form a party within the state at variance with the state religion and the state government. To the political necessity which forced the governing powers to suppress religions other than that by law established, add the intense feeling each person had that his religion was the only true religion and the bitterness of the struggle between those demanding and those opposed to religious liberty is easily understood. That the political rulers dreaded the revolutionary possibilities of religious dissent; and the ecclesiastical authorities feared that the freedom to teach heretical doctrines would lead the souls of men to perdition, and on these grounds honestly sought to prevent such dissent and heresy by measures more or less severe, will not be doubted. But eventually the more clear-visioned statesmen saw that the evils resulting from this policy of religious suppression and oppression were a greater menace to political stability and to religion itself than any which could come from a reasonable religious freedom.

The first attempt to grant and try out religious freedom must be credited to Constantine in the Edict of Milan, 313 A.D. This edict granted «both to the Christians and to all others free power of following whatever religion each may have preferred . . . The absolute power is to be denied to no one to give himself either to the worship of the Christians, or to that religion which he thinks most suited to himself.» This exceedingly liberal decree did not inspire his successors. Not until we come to the American State constitutions is so broad a statute met with. Between 313 A.D. and approximately 1775, religious freedom, with but one or two exceptions, was never conceded. Acts of toleration more or less generous, usually less, were occasionally granted with the hope of effecting a compromise. The practice of persecuting persons for dissent and heresy gradually went out of fashion. More and more frequently the courts ruled that it was not the business of law to prohibit a person from exercising his religious faith so long as it did not, as Blackstone put it, «threaten ruin or disturbance of the state.» In the recent (1918) trial of the followers of Pastor Russell the court made it plain that religious freedom never could be stretched to confer the right to commit crime.

Toleration was not the end sought. Toleration is simply a favor granted. Toleration kept alive all sorts of political and other disabilities. In New England a person could not enjoy the franchise unless he were a member of a particular church in good and regular standing. In Europe similar disabilities were laid upon persons who refused to conform to the state's religion. Toleration was as odious as oppression. What was all along demanded was the right of absolute equality of all religions before the law.

America led the way to this goal. It was the first and for a long time the only country to write the principle not of toleration but of religious freedom into the fundamental laws. What is perhaps the earliest attempt since the Edict of Milan to grant something like religious freedom is found in the Maryland Toleration Act of 1649. It reads «Whereas the enforcing of the conscience in matters of Religion hath frequently fallen out to be of dangerous consequence in those commonwealths where it hath been practiced, and for the more quiet and peaceable government of this Province, and the better to preserve mutual Love and amity amongst the Inhabitants thereof; Be it therefore . . . enacted . . . that no person or persons within this Province . . . professing to believe in Jesus Christ, shall henceforth be in any ways troubled, molested or discountenanced for, or in respect to, his or her religion, nor in the free exercise thereof . . . nor in any way compelled to believe or exercise any other religion against his or her consent, so that they be not unfaithful to the lord proprietary, or molest or conspire against the civil government.» Just how much the liberal spirit toward religious differences which actuated the Plymouth colonists contributed to the establishment of religious freedom in America there is no way of telling. The contribution was undoubtedly large. More conspicuous if not more important is the work in this direction of Roger Williams, founder of Rhode Island. To secure real religious liberty was the ambition of his life. His great desire was «to hold forth a lively experiment, that a most flourishing civil state may stand and best be maintained with a full liberty of religious concernments.» The charter issued in 1663 reads «No person within the said colony (Rhode Island), at any time hereafter, shall be in any wise molested, punished, disqualified, or called in question for any difference of opinion in matters of religion: every person may at all times freely and fully enjoy his own judgment and conscience in matters of religious concernments.»

Although religious persecutions and disabilities continued far into the 18th century in many parts of America the principles of religious liberty were gradually becoming clearer and more firmly established. When, therefore, during the Revolutionary period and soon thereafter the various States made constitutions for themselves, liberty of religion was one of the things most explicitly provided for. The Constitutional Convention of Virginia, 1776, led the way in its adoption of the Bill of Rights. The amendment proposed by Madison and adopted puts the point clearly, «No man or class of men, ought on account of religion to be invested with peculiar emoluments or privileges, nor subjected to any penalties or disabilities, unless under color of religion the preservation of equal liberty and the existence of the state are manifestly endangered.» Jefferson points out that the law of October 1785 entitled, «An Act Establishing Religious Freedom» in Virginia was designed to «comprehend within the mantle of its protection the Jew and the Gentile, the Christian and Mahometan, the Hindu and Infidel of every denomination.» The provisions of the act itself are so broad as to be virtually the last word in the matter. «Be it enacted by the General Assembly, that no man shall be compelled to frequent or support any religious worship, place, or ministry whatever; nor shall be enforced, restrained, molested, burthened in his body or goods, nor shall otherwise suffer on account of his religious opinions or belief; but that all men shall be free to profess, and by argument to maintain, their opinion in matters of religion, and that the same shall in no wise diminish, enlarge, or affect their civil capacities.» Other States were moving in the same direction though not always with the same completeness. Some States hesitated to grant fullest liberty. Thus Pennsylvania, while conceding that «all men have a natural and inalienable right to worship God, according to the dictates of their own conscience,» required office holders (1776) to affirm belief in God, in future rewards and punishment and the divine inspiration of the Old and New Testaments. This test was abolished by the constitution of 1790, but the case of Updegraph v. the Commonwealth in 1824 disclosed the curious fact that it is still unlawful in Pennsylvania «to speak lightly or profanely of Almighty God, Christ Jesus, the Holy Ghost or the Scriptures of Truth.» But despite this, and evidencing that full religious liberty no longer even waits on the law, Jews, Unitarians, Ethical Culturists and non-Christians are free to worship as they will and suffer no sort of disability therefrom. It is hardly necessary to state that the United States Constitution most effectively guarantees full liberty of religion. «Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof.» The situation in the United States may be summed up as follows: All the State constitutions provide that no law can be passed establishing a religion, no person can be compelled to attend any form of religious service, or contribute to the support of any religion. No restraint can be put on the free exercise or expression, or promulgation of any religion. But this freedom must not be «so construed as to excuse acts inconsistent with the peace and safety of the state.»

A limitation of religious freedom not contemplated in the statute or in judicial decisions came to light in the Crapsey heresy trial of 1906. Against the defendant's claim of the right of freedom to teach what he conceived to be the truth in religious doctrine it was argued by the prosecution that as a regularly ordained priest of the Episcopal Church and by the terms of his ordination he was free only to teach what the Church set forth as true, and this argument was sustained by the ecclesiastical court that tried the case. It is doubtful whether that decision can be construed as a contradiction of the principles of religious liberty for which men fought so long. But «gradually,» as Herbert Spencer remarks, «during recent centuries, the right of free speech on religious matters, more and more asserted has been more and more admitted; until now there is no restraint on the public utterance of any religious opinion, unless the utterance is gratuitously insulting in manner or form.»

The literature of the subject is widely distributed through various historical writings and the contemporary chronicles of different periods. A very sound and comprehensive survey of the subject will be found in Sanford H. Cobb's ‹Rise of Religious Liberty in America.›

CHARLES GRAVES.

LIBERTY, Statue of, the name of a colossal statue on Bedloe's Island in New York harbor. On 28 Oct. 1886, after more than 12 years of preparation, this statue, given by the people of France to the United States, was dedicated and unveiled. The statue was the conception of M. Frédéric Bartholdi, who designed it for the Franco-American Union in 1874. It was built by popular subscriptions in France to commemorate the hundredth anniversary of American independence, and required over five years for its completion. It was mounted in Paris in October 1881. The American pedestal for the statute was not commenced till April 1883, and was finally finished in 1886. This was built by popular subscription. The statue was erected on an iron framework bolted firmly to the stone pedestal. It was dedicated 23 Oct. 1886. The statue, which is of bronze, is of the following dimensions:

	Feet	Inches
Water-level to top of pedestal	149	10
Statue proper to top of torch	151	5
Total height from water-level	301	3
Heel to top of head	111	6
Length of hand	16	5
Index-finger	8	0
Circumference at second joint	7	6
Size of finger-nail	13 x 10 in.	
Head of chin to cranium	17	3
Head-thickness from ear to ear	10	0
Distance between the eyes	2	6
Length of nose	4	6
Right arm, length	42	0
Right arm, greatest thickness	12	0
Thickness of waist	35	0
Width of mouth	3	0
Tablet, length	23	7
Tablet, width	13	7
Tablet, thickness	2	0

The statue weighs 450,000 pounds or 225 tons; the bronze alone weighs 200,000 pounds. Forty persons can stand comfortably in the head, and the torch will hold 12 people. The number of steps from the base of the foundation to the top of the torch is 403; from the ground to the top of the pedestal 195 steps. The number of steps in the statue from the pedestal to the head is 154, and the ladder leading up through the extended right arm to the torch has 54 rounds. The cost of the statue is estimated at $250,000; the cost of the pedestal and the erection of the statue, $350,000; total cost of the work completed, $600,000. The light in the torch at the top of the Statue of Liberty is maintained by the lighthouse service of the government. On 2 Dec. 1916 arrangements were completed for the permanent lighting of the entire statue, the signal being given by President Wilson for the turning on of the lights. The funds for the permanent illumination were collected by the New York *World* through popular subscription. Liberty exceeds in height the Colossus of Rhodes, which was said to have been about 105 feet high. That of Nero is said by Suetonius to have been 120 feet high. The statue of Charles Borromeo, which is still standing on the Lake of Geneva, is 66 feet high and is mounted on a pedestal measuring 46 feet. The celebrated statue of Jupiter carved by Phidias is said to have been 60 feet in height.

LIBERTY BELL, the bell which formerly hung in the dome of the old State House (Independence Hall), Philadelphia, and was rung to announce the signing of the Declaration of Independence, 4 July 1776. It was cast in England especially for the State House and was brought from there in 1752; in being taken from the ship it met with an accident which spoiled its tone, and it was recast in Philadelphia in 1753, when the words «Proclaim liberty throughout all the land unto all the inhabitants thereof» (Lev. xxv, 10) were inscribed on it. When the British occupied Philadelphia the bell was taken down and hidden in the Delaware River near Trenton, but was afterward hung in its old position, and for several years rung every Fourth. On 8 July 1835 it was broken while tolling for the death of Chief Justice Marshall. In 1854 it was placed in the hall of the old State House on a pedestal with 13 sides, representing the number of original States. In 1893 it was carried to Chicago for the World's Fair, and in many cities through which it was carried was greeted with special demonstrations; and has since been specially exhibited at expositions in other cities, notably at Saint Louis 1904 and at the Panama-Pacific Exposition, San Francisco, 1915. Consult Belisle, ‹History of Independence Hall.›

LIBERTY BOYS, a popular name given the Sons of Liberty during the American Revolution.

LIBERTY PARTY, the first political organization of the American Abolitionists (q.v.). The Anti-Slavery Society was composed of two wings steadily and at last decisively diverging: the politicals, who wished the work to be carried on as other reform measures are, by massing its supporters, and either winning a decisive victory or extorting gradual compromises from its opponents: and the Garrison wing, who refused to vote, hold office or in any way recognize a government which legitimized slavery, denounced the Constitution and denounced the churches and ministers for refusal to join the movement. The violence of this branch and the revolutionary and sometimes offensive social theories associated with it made the other wing anxious to part company; and this was brought about in 1838 by suggesting the nomination and support of abolitionist candidates. The next year, on the refusal of the Garrisonians to listen, the political wing split away and in 1839–40 organized the «American and Foreign Anti-Slavery Society.» Among the leaders of this secession were James G. Birney, Arthur Tappan, Gerrit Smith, J. G. Whittier, Edward Beecher, John Jay and Thomas Morris. In a convention at Warsaw, N. Y., 13 Nov. 1839, this branch nominated Birney (a Kentucky ex-slaveholder) for President and Francis J. Lemoyne for Vice-President. A national convention (mainly from New York) was held 1 April 1840, confirmed these nominations and took the name of the Liberty party. The nominees refused to accept, but were voted for none-the-less, and received 7,059 votes in the Harrison-Van Buren election of 1840, of which 2,798 were from New York State. During the next four years the party put up tickets in various local elections. On 30 Aug. 1844 it held another national convention at Buffalo. Polk was already nominated by the Democrats, on the issue of Texas annexation, which Clay had dodged, securing the nomination by the Whigs; but the Liberty party had pronounced against all ostrich policies or candidates and nominated Birney again, with Thomas Morris of Ohio as Vice-President. They received 62,300 votes, all in the North and Northwest, except 15,812 in New York. Small as this vote was, it turned the scale in New York and Michigan against Clay and elected Polk, the Southern Democrat; decided the annexation of Texas and reinforced the slave party with new territory six times the size of New England. This result, however it might prove the potential power of the party, was not wholly satisfactory, and although they polled 74,017 votes in the elections of 1846, it was evident that a pure Abolitionist party was premature. The Abolitionists, therefore, dropped their separate organization, and although they had nominated John P. Hale for President and Leicester King for Vice-President in 1847, these candidates withdrew and in 1848 and 1852 their adherents voted for the candidates of the Free Soil party (q.v.). It was felt that they accomplished much more by strengthening the forces of this practical movement, whose enemies were constantly playing into their hands, than they could have done with the straight ticket. After the rise of the Republican party the former Abolitionists formed part of its reliance and advance guard.

LIBERTY OF THE PRESS. Liberty of the press means not only freedom to publish one's thought in printed form but freedom of speech as well, there being no essential difference between the written and spoken word. Liberty to publish by speech or print one's own opinions, subject to certain limitations which can hardly be said to limit the fundamental principle, is regarded as one of the natural or absolute rights of man. The Bill of Rights (1689), while making no mention of liberty of the press, stipulates «that the freedom of speech and debates or proceedings in Parliament ought not to be impeached in any court or place out of Parliament.» The constitutions of Pennsylvania, Delaware, Maryland and North Carolina, all adopted in 1776, are the earliest declarations of any legislative authority in favor of the liberty of the press. With the adoption in 1791 of Article One, amending the United States Constitution, by which it is commanded that «Congress shall make no law . . . abridging the freedom of speech or of the press,» the principle of a free press and free speech is for the first time written into the fundamental law of an important nation. In 1768 a Massachusetts legislative body refused to support Governor Bernard in his demand that the editor of the *Gazette* be punished for libeling his honor and asserted instead that «the Liberty of the Press is a great Bulwark of the Liberty of the People: It is therefore the incumbent Duty of those who are constituted the Guardians of the People's Rights to defend and maintain it.»

The struggle for a free press began almost immediately after the introduction of printing. Though actually antedating the Reformation by a century it was not until Luther's time, however, that the printing press revealed itself as a powerful agency in the wide and rapid distribution of ideas, creating new public opinion and stirring men to united action. Contemporary writers mention with amazement that in 14 days Luther's theses were found in every corner of Germany; in a month they had gone to the ends of Christendom «as though the angels were the postmen.» And so, as Putnam points out, early in the 16th century «the rulers of the State and the authorities of the church began to find occasion for alarm at the increasing range of the printed word, and came to the conclusion that if the community was not to be undermined by . . . dangerous and demoralizing opinion, measures must be taken to maintain supervision and control over the production of books.» This was hardly a new thing for the rulers and authorities to attempt. From the time of Augustus down, rulers of empire and Church had perceived the danger to the power and permanence of their rule in allowing men to speak and write freely in criticism of prominent persons and the established order, and uttering and advocating ideas subversive of those upon which the then existing political sway rested. The question whether those in authority who prohibited free speech and a free press were as pure-minded and as clean-purposed as those who fought for such freedom does not enter into the discussion. The situation as it existed, and still exists, is that the organization of State and of Church represents certain social ideas and relations, also certain ideas which should govern the rights, authority and power of the rulers and the duties and obligations of the people. In Luther's time, and before, satisfied — whether selfishly or unselfishly was not the point — that such organization and order were little or nothing short of divine in truth and worth, it was the natural, the inevitable thing for those in authority to try and suppress any and every word written or spoken which criticised or expressed a doubt as to the wisdom and validity of the existing order. As there would be no restriction placed upon those who spoke and wrote in favor and support of the established order, it is clear that the men struggling for a free press and free speech were inevitably those who, for reasons good enough for them, were opposed to things as they were, who were advocating ideas that were more or less revolutionary.

According to Tacitus, Augustus was the first ruler to undertake to punish a word written or spoken. The writings of Vejinto were suppressed by Nero. Concerning this incident Tacitus remarks, «so long as the possession of these writings was attended with danger, they were eagerly sought and read; when there was no longer any difficulty in securing them they fell into oblivion.» From 150 A.D. and on, the Church increasingly made it a practice to issue edicts against books. The fifth Council of Lateran, 1516, adopted a papal constitution which recited the injury to faith, morals and the public peace arising from the increasing number of books opposed to religion or making libelous attacks on individuals. In Scotland in 1585 the authors of libels against the king of Scotland were punished with death, and it was the king or his servants who determined whether the king had been libeled. In 1680 12 English judges solemnly resolved «that all books which are scandalous to the government may be seized and all persons so exposing them may be punished. And further, that all writers of news, though not scandalous, seditious nor reflective upon the government or State, yet, if they are writers (as there are few else) of false news, they are indictable and punishable on that account.» As late as 1808 a high judicial authority declares that it is «not to be permitted to any man to make the people dissatisfied with the Government under which he lives.» Milton's 'Areopagitica' (1644) tells with matchless force how great were the efforts made to «stifle the voice of argument, to ban and proscribe the press» or compel it to utter only such sentiments as meet the approval of those in authority. From the outset the problem was not whether a person ought or ought not to be free to publish whatever idea he believed to be true and good, but whether that was for the public good and safety. The free publication and distribution of literature advocating doctrines sufficiently antagonistic to the existing order to cause a war plainly could not be permitted, at least so it would seem. The champions of a free press saw clearly enough that this was after all by no means the point at issue. They had no desire for freedom to stir up rebellion, to slander and defame and lead astray. There were a thousand and one things that were all wrong in the existing order and all they asked was freedom to discuss the faults and follies, the corruptions and defects, and bring forward if possible ideas which could be made the foundations of a better social and political order. To the charge that the ideas being advocated by those who demanded freedom of speech and press were abominable and menacing error and could lead only to anarchy the reply was that «error of opinion may be tolerated where reason is left free to combat it» or to use the words of Mill, «complete liberty of contradicting and disproving our opinion is the very condition which justifies us in assuming its truth for purposes of action; and on no other terms can a being with human faculties have any rational assurance of being right,» and so to prohibit discussion and free publishing of opinion is to «determine the judgment by an influence other than reason.» Furthermore it could be effectively answered that the opponents of liberty of speech and press were assuming not only the responsibility of maintaining public order and safety but were claiming infallibility of understanding and judgment. Dr. Robert Hall in his address «An Apology for the Liberty of the Press» (1793) presents the matter in another fashion, «When a nation forms a government, it is not wisdom but *power* which they place in the hands of a magistrate; from whence it follows, his concern is only with those objects which *power* can operate upon. On this account the administration of justice, the protection of property, and the defense of every member of the community from violence and outrage, fall naturally within the province of the civil ruler, for these may all be accomplished by *power;* but an attempt to distinguish truth from error, and to countenance one set of opinions to the prejudice of another is to apply power in a manner mischievous and absurd.» That was the basis of the contention: the government whose chief business it is to preserve order by punishing crime transcends its authority and function when it proposes to determine whether this or that opinion is true. As Mill points out, when it comes to the government's passing judgment on the impiety or falseness of a word written or spoken, the cases of Socrates, of Jesus and of many others indicate the menace of such exercise of authority. When a person utters sedition or incites to crime he is hardly expressing an opinion, he is plainly guilty of criminal conduct. Words are sometimes deeds. Beginning with Milton's masterly defense of the liberty of the press there is manifested a slowly growing appreciation of the need and the possibility of keeping the press and speech free without giving free rein to those who are criminally minded. That this became the attitude of judicial authorities is seen in the opinion of Lord Wynford in Rex v. Burdett: «My opinion of the liberty of the press is that every man ought to be permitted to instruct his fellow-subjects; that every man may fearlessly advance any new doctrines, provided he does so with proper respect to religion and government of the country; that he may point out errors in the measures of public men, but he must not impute criminal conduct to them. The liberty of the press cannot be carried to this extent without violating another equally sacred right, the right of character. . . . Where vituperation begins, the liberty of the press ends.» Of much more importance in the history of the struggle for a free press is the earlier incident of the trial of John Peter Zenger in New York, 1735, for «publishing a false, scandalous and seditious libel, in which . . . the king's immediate representative here is greatly and unjustly scandalized.» It established once and for all in North America «that in prosecution for libel the jury were the judges of both the law and the fact.» Even more significant is the temper of the people which this trial revealed. The jury despite explicit instruction of the court to the contrary brought in a verdict of «not guilty.» The mass of the people had come to see that the highest public welfare and safety depended upon the right of man to protest freely against and expose publicly all wrong doing, particularly any evil doing or oppression of rulers. This right, as already pointed out, was clearly embodied in the Constitution of the United States and the constitutions of several States some 50 years later. But Louisiana in the constitution adopted in 1868 puts it down quite explicitly «printing presses shall be free to every person who undertakes to examine the proceedings of the legislature or any branch of government, and no law shall ever be made to restrain the right thereof.» This same constitution recognizes very emphatically the fact of life which moved the most scholarly and large minded of men to champion the cause of a free press, viz.: that political and economic and intellectual freedom and progress, without which life is less than human, are impossible without liberty to speak and publish one's thoughts and opinions. So the Louisiana constitution continues: «The free communication of thoughts and opinions is one of the most invaluable rights of man and every citizen may freely speak, write and print on any subject, being responsible for the abuse of that liberty.» The fundamental laws of most nations as reconstituted or modified during the last century attempt to provide for the «free communication of thoughts and opinions» without conferring the right to commit what may properly be regarded as crime. A few instances will serve to give the general situation. The Belgian Constitution of 1831 declares that the press is free, that censorship shall never be established; sureties shall not be exacted from writers, editors, printers, and when the author is known and domiciled in Belgium the printer and bookseller cannot be prosecuted. But an author or speaker must not incite to crime or disobedience of the law; nor may he attack the constitutional authority or inviolability of the dynasty, nor the authority and rights of the chambers. In Italy the press has been free under fairly reasonable restrictions since the law of 1848, but Spain led the way among European nations. The constitution of 1812 promulgated by the regency in the name of Ferdinand VII provides «that all Spaniards shall have liberty to write, print and publish their political ideas without any necessity of license, examination or approbation previous to publication,» subject of course to restrictions imposed by law. Austria-Hungary in the fundamental law of 1867 declares every one has the right of freely expressing his thoughts within the limits imposed by law. Germany, in the constitution of the empire, declares the press to be free subject to usual limitations of law. The law of 1878, however, gives the police very large powers over the socialistic press. The French law of 1881 begins by asserting the liberty of the press and bookselling under certain restraints which are plainly designed in the interests of justice and the public weal. Qualifying these constitutional declarations of freedom by certain restrictive laws, while in theory a contradiction of the principle, in fact is hardly so. It is only what the constitution of Louisiana means by declaring that a person is to be held «responsible for the abuse of that liberty.» Herbert Spencer puts the matter clearly enough: «So long as he does not suggest the commission of crimes each citizen is free to say what he pleases about any or all of our institutions — even to the advocacy of a form of government utterly different from that which exists, or to the condemnation of all governments.» Censorship in war-times can hardly be pointed out as denial or as overthrow of the principle of a free press now so fairly well established. It will hardly be held that anyone has any more of a right to say or write a word which will lend aid and comfort to the enemy than he has to aid an enemy by armed insurrection. The ease and speed with which information can be transmitted makes it necessary to put the publishing of news in war time under restrictions hitherto undreamed of. Writers on this subject of a free press have felt it necessary to direct attention to the menace contained in the «Act of Congress approved 26 Sept. 1888» and the former act of 1878 which designed to prevent distribution through the mail of obscene matter and matter offensive to the public taste. The menace is not in the thing aimed at but in the fact that it gives to an official in the Post Office Department absolute power to determine whether an article in a newspaper or periodical or a chapter in a book is obscene or offensive to good taste, and from his decision there is no appeal, and no redress even if he should be wrong. No less a man than Thomas Erskine a century ago pointed out the serious menace in allowing any individual, or even a self-appointed group of individuals, to determine what is offensive to good taste. It is not likely that the liberty of the press will have to be fought for again.

The bibliography on this subject is scattered and the subject is usually discussed as a part of the larger subject of personal and individual liberty. Milton, John, ‹Areopagitica,› is the great classic; consult also Mill, J. S., ‹Essay on Liberty›; ‹Trial of John Peter Zenger›; Putnam, G. H., ‹Books and Their Makers in the Middle Ages›; Schroeder, T., ‹Free Press Anthology.›

CHARLES GRAVES.

LIBERTY TREE, (1) a famous ballad of the Revolutionary War, written by Thomas Paine in 1775. (2) An old elm tree in Boston upon which the citizens hanged in effigy British officials connected with the Stamp Act and its enforcement.

LIBI-DIVI, lē'bē-dē'vē. See DIVI-DIVI.

LIBIDO, a term introduced into analytic psychology in 1895 by Sigmund Freud of Vienna and used by him to denote the vital urge or drive or craving, which is behind all human endeavor and especially the desire of the reproductive instincts. Jung of Zürich has substituted for it the term Hormé [Greek: ὁρμή]. The libido is regarded as having two main phases or aspects: the sexual, or race preservative, and the nutritive, or self-preservative. Every human activity is regarded as satisfying in some form one or the other of these spheres of desire and as the result of the specification in concrete reality of one or other of them. Thus various forms of art may be the expression of the sexual libido, and various callings and professions and types of business activity such as dealing in foods or in clothing are expressions in different forms of the self-preservative urge. This point of view is of great importance, particularly in the psychotherapeutics of certain psychogenic nervous disorders. In hysteria, for example, the libido is regarded as fixated on the physiological level with the result that there is an exaggerated activity in some of the physiological processes producing an increased flow of blood or lymph or certain of the internal secretions in some of the organs, producing in turn a change in metabolism which causes an over-development. This is termed a hysterical conversion and is made manifest in many of the symptoms so varied in hysteria. In compulsion neurosis, on the other hand, the libido becomes fixated at an early age upon certain psychic elements with the result that special forms of thought, compulsive fear, compulsive doubt, compulsive action, etc., occur, without producing any specific change in the physiological functions. Analytic psychology, as practised therapeutically by physicians, aims to resolve the fixations of the libido and thus free the patient from his physical symptoms or from his mental inhibitions and therefore to educate him in such a way as to be better able to fulfil the requirements imposed upon him by society. Consult Jelliffe, 'Technique Psychoanalysis' (New York 1918).

LIBMANAN, lĭb-mā-nän, or **LIBANAN,** lē-bä' nän, Philippines, pueblo of the province of Ambos Camarines, Luzon, situated on the Polanluna River near its confluence with the Naga, 10 miles northwest of Nueva Cáceres. It is on the main road, and is a telegraph and military station. It has also important hemp and rice industries. Pop. 14,500.

LIBRA, (1) the ancient Roman pound weight, also a Spanish and Italian weight. Translated into modern grains Troy, these ancient libra vary, but are usually between 5,000 and 7,000 grains. (2) The original meaning is balance or pair of scales. (3) One of the ancient zodiacal constellations. The seventh sign of the zodiac is called Libra, because at its first point the ecliptic crosses the equator to the southern hemisphere, and we have then the autumal equinox, when day and night are, as it were, equally balanced.

LIBRARIES, Ancient. The written word in some form or other is of immemorial antiquity. Discoveries in Crete and Assyria-Babylonia and at Susa (Persia) have proved that relatively advanced civilizations were in existence as nearly as 6000 years B.C., and that the art of writing had been developed at that time. Some of the collections of stone and clay tablets unearthed at Knossos (Crete) and Nippur (Babylonia), seem to have the characteristics of libraries, even according to the strict definition of the term 'library (Latin *liber*, book): a collection of books or other literary material preserved for reference or study; the designation also, by association, of the place or building wherein they are kept. This doubtless cannot be said of many finds of ancient cuneiform tablets for these were merely legal, commercial or sacerdotal archives, but others are historical, philosophic or epical,— pure literature in fact. The fact that stone and clay records have been preserved does not prove that more perishable materials were not used, for there is an example of Egyptian hieratic writing dating back to 3,000 years B.C. in the Louvre. The incised stone records of Egypt, many of them of immense antiquity, contain references to papyrus rolls. The roll (Latin *volumen*, volume) was the first stage in the development of the book, the second being the *codex* or the book as familiarly known, consisting of separate sheets bound together. This was probably a development of waxed tablets, used by the Greeks, the adoption of which has been traditionally ascribed to the kings of Pergamus who were forced to use parchment (*Pergamentum*) for their books, the Egyptians having placed an embargo on papyrus. Just when paper supplanted parchment is not definitely known, but the indications are that the Arabs were the first to make and use paper, Arabian manuscripts of the 9th and 10th centuries being in existence. Paper mills were in operation during the 12th century. Paper was known to the Chinese at a very early date, but the ancient Chinese book is a phase of the subject yet to be investigated. Recent explorations have added a most astonishing store of knowledge regarding the ancient world and there is little obscurity now regarding the existence and constitution of the libraries of the Classic Orient. The investigations of Paul Émile Botta, Sir Austen Henry Layard, Dr. John P. Peters and his successors, Dr. John Henry Hayes and Dr. H. V. Hilprecht of the University of Pennsylvania, have proved that a library in the strict sense of the term formed a part of nearly every temple and probably every royal palace. More than 50,000 tablets have been found, comprehending historical and traditional records, epical narrations, folksongs and ballads, hymns and prayers, medical lore and philosophy. Thus the temples were centres of literary as well as religious activity, the temple of Enlil at Nippur, that of the Sun-god at Sippar and others in Babylonia possessing large collections of tablets.

Assyro-Babylonian Empire.— Asur-banipal (668–626 B.C.), known in Greek history as Sardanapalus, the grandson of the Biblical Sennacherib, was the first ruler of Assyria recorded to have taken an interest in the collection of literature. "Being endowed with an attentive ear, and inclined to the study of all tablets," he commanded that a great collection be gathered together in Nineveh to form the royal library. This was classified and indexed, and fortunately left undisturbed when Nineveh fell into ruins. Thousands of tablets from this library are in the British Museum and constitute one of the great sources of knowledge regarding Assyro-Babylonian civilization.

Egypt.— It is impossible to say whether the libraries of ancient Egypt antedate those of the Assyro-Babylonian empires or not. Scribes, however, were known in Egypt as early as 6000 B.C. As in Assyria-Babylonia, the temples were centres of learning in which were gathered records and literary productions of all kinds. The rulers often encouraged learning and made collections as is evidenced by hieroglyphic inscriptions on their tombs and monuments. A reference of this nature is contained in an inscription on a tomb near the Pyramid of Cheops (Khufu), and another inscription refers to the library (collected works) of Khufu. Papyrus was undoubtedly used in Egypt at a very early date, one of the most ancient examples being a roll relating the acts of King Assa (3580–3536 B.C.). An early example of a purely literary papyrus is the Prisse papyrus, composed about 2500 B.C. Professor W. Flinders Petrie, during his researches in Fayûm, discovered papyri in mummy cases that dated back 3000 or more years B.C. That clay tablets were also used by the Egyptians is proved by his discovery of a collection of the reign of Amenophis IV (Amenhotep, 1466 B.C.). These were unearthed at the site of the king's palace in the city founded by him, Tel-el-Amarna. Heliopolis, the city of the Sun God, prior to the rise of Alexandria, was the centre of Egyptian culture. Here were numerous temples, each of which had its library of papyri, among them the famous Sacred Books of Thoth, an encyclopedia of ancient wisdom. Brugsch, in his ‹True Story of the Exodos› (p. 204), states that there was a library in the temple at Edfu, on the walls of which was a list of the works contained in the collection. The most noted library of ancient Egypt was that formed by King Osymandyas, who has been identified with the Biblical Rameses II (1300–1236 B.C.). This collection was in the palace of the king, the Ramesseum, Thebes, and is described by Didorus Siculus (I, 58 Wessling ed.) as «the dispensary of the mind.» The Persian subjugation under Cambyses (527 B.C.) marks the close of Ancient Egyptian culture and undoubtedly many collections of literature were destroyed during that period. The Persian influence was succeeded by the Greek and then the Roman, hence the later library history of Egypt properly belongs to those nations.

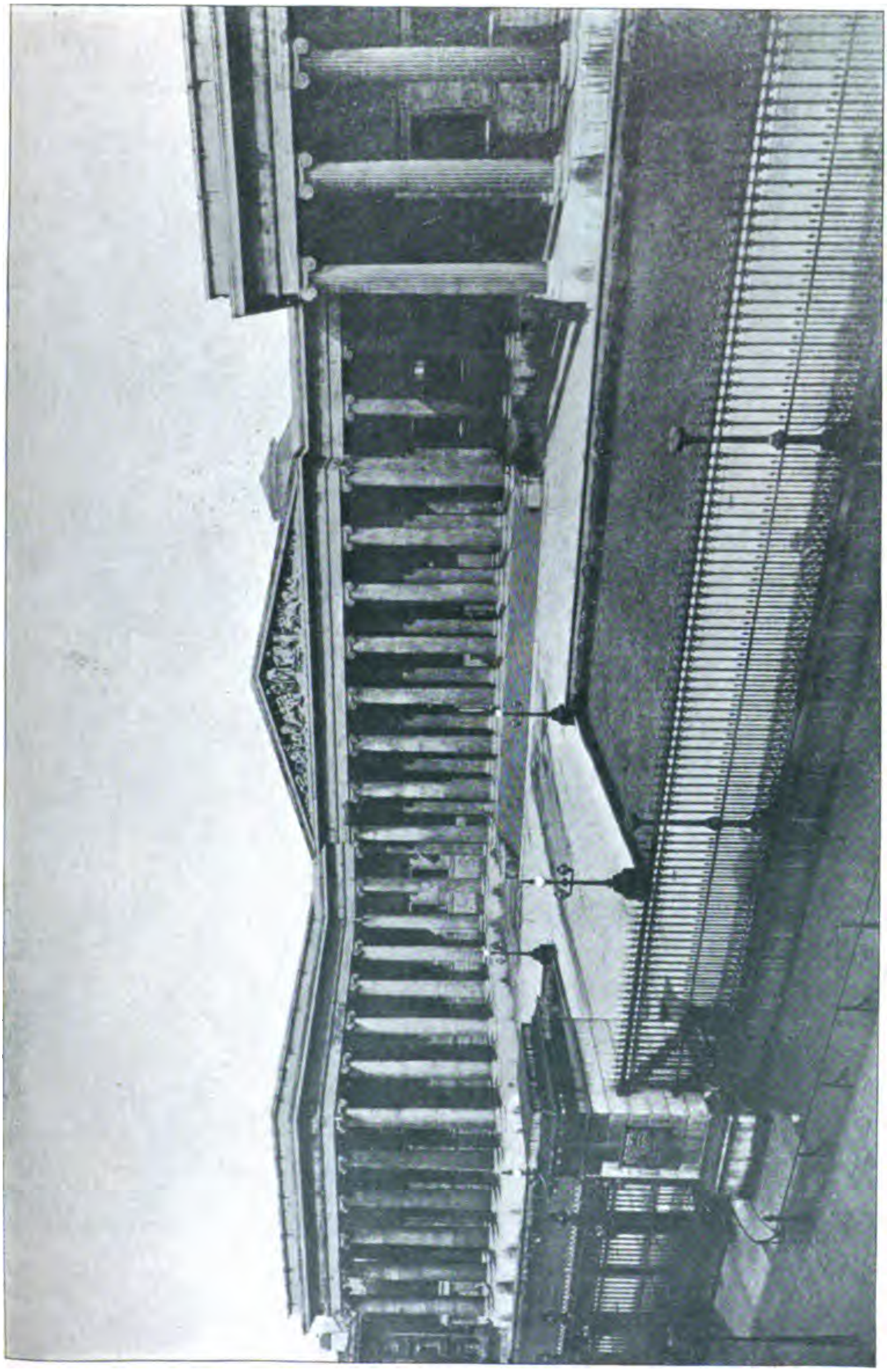
Ancient Greece.— Greek papyri of great antiquity have been found in Egyptian tombs, one of these, discovered at Abusir, near Memphis, dating as early as 4000 B.C. We do not know just when collections of literature began to be made, for classic historians state that libraries were first developed when Greece had already reached a very high degree of civilization. Thus Aulus Gellius asserts that the first library of Greece was founded by Pisistratus (605–527 B.C.). The same tradition is repeated by Athenæus. That Pisistratus was a notable patron of learning is unquestioned, yet collections undoubtedly antedated his. The tradition that he founded the first library doubtless arose from the fact that he was responsible for the collecting and editing of the various poems of the Homeric cycle. Polycrates, the tyrant of Samos (d. 522 B.C.), and friend of the poet Anacreon, was also a patron of letters and is said to have formed a library. Others known to have been collectors and lovers of books were Nicocreon of Cyprus, the kings of Pergamus, Euripides the poet, Euclid the mathematician, Aristotle the philosopher and Neleus, his biographer (Athenæus, ‹Deipnosophistæ,› lib. c. 4). Strabo asserts that it was Aristotle himself, who formed the first library in Greece and gives a graphic description of its vicissitudes, which included its burial for many years to keep it out of the rapacious hands of the kings of Pergamus, antiquity's prototypes of the modern bibliomaniac. The most famous libraries of Greek antiquity, however, were those at Alexandria, developed during the régime of the Ptolemies. See ALEXANDRIAN LIBRARY.

Pergamon Libraries.— Hardly less famous than the Alexandrian libraries were those founded by the kings of Pergamus. During the two centuries prior to the Christian era, Greek civilization reached an astonishing height in the cities of Asia Minor. Among these, Pergamon was the most noted for its love of art and letters. Under Attalus I (241–197 B.C.) and his son, Eumenes II (197–159 B.C.), the city was beautified, objects of art were created or imported in great numbers and learning in every form was encouraged. It is probable that Attalus founded the libraries of Pergamon, but it was his successor that developed them, seeking throughout the world to obtain texts by any means and from any source. It has already been noted that Aristotle's library, according to Strabo, was hidden away in a cave in order to prevent its falling into the hands of the agents of the kings of Pergamon. Strabo, however, wrote more than a century after these happenings and, as he is often in error, this story is interesting more for the light it throws upon the methods pursued in developing the libraries of Pergamon. At any rate they grew until they rivaled those of Alexandria, causing, it is said, an embargo on papyrus, so that the Pergamoi were forced to resort to parchment (*pergamentum*). This tradition also may be accepted with caution, for sheepskin had long been used for manuscripts in Greece.

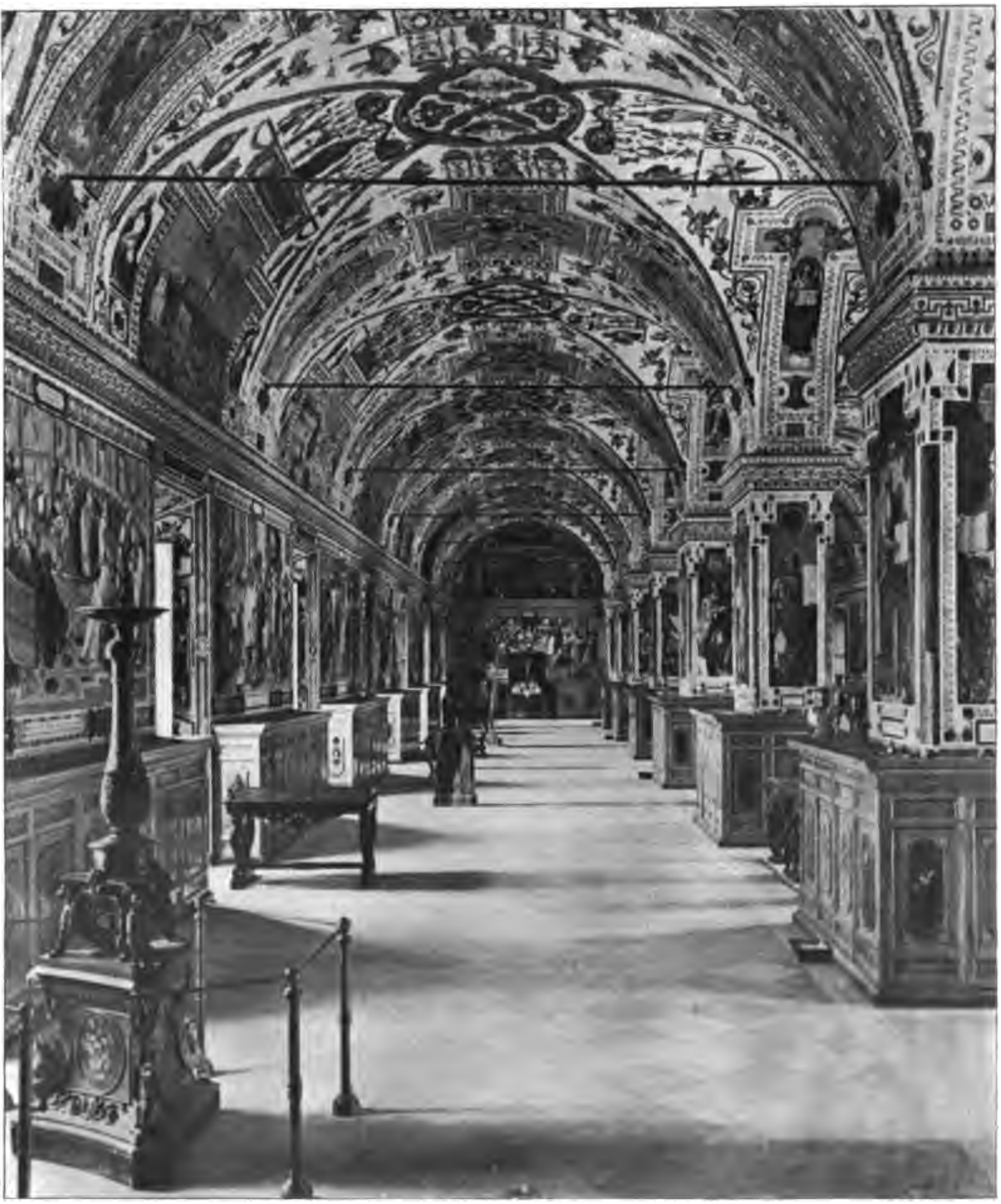
How many rolls and codices were in the libraries of Pergamon it is impossible to estimate. About the only reference to their number is the passage from Plutarch, wherein Antony is accused in Rome of presenting Cleopatra with the collections of Pergamon,— «more than 200,000 separate volumes.» The Acropolis of Pergamon was excavated in 1878 and the rooms assigned to the library determined. They form the subject of a monograph by Couze — ‹Die pergamen Bibliotek› (1884).

Ancient Rome.— There is little evidence in ancient literature indicating Roman interest in libraries prior to the wars with Greece. Rome conquered Greece, but in turn was conquered by Greek culture. It is narrated that Lucius Æmilius Paulus, who defeated Perseus and overthrew the Macedonian Empire in 168 B.C., carried the library of Perseus to Rome, «the first that was seen in the capital of the world.» Thus Sylla, after subjugating Athens, gathered from Athenian books a library alike extensive and choice. (Consult Bacmeister, ‹Essai sur la Bibliothèque de l'Académie des Sciences de Saint Pétersbourg,› quoted in Edwards, ‹Memoirs of libraries,› Vol. II, p. 544). Lucullus (110–57 B.C.) who had been a general in the Mithridatic wars and had returned to Rome under the spell of Greek and Oriental civilization, is the first Roman distinguished as a collector of books. Plutarch, in his life of Lucullus, says: «His furnishing a library, however, deserves praise and record, for he collected very many choice manuscripts; and the use they were put to was even more magnificent than the purchase, the library being always open and the walks and reading-rooms about it free to all Greeks, whose delight it was to leave their other occupations and hasten thither as to the habitation of the Muses.» Pliny states that Caius Asinius Pollio (76 B.C.–6 A.D.) founded the first public library in Rome. It has been seen that the library of Lucullus was open to readers but they were mainly his friends, the library thus never wholly losing the character of a private collection. Pollio, in founding the public library, was undoubtedly carrying out a plan of Julius Cæsar, to form libraries throughout all Rome, unfortunately miscarried by his death. (Suetonius *Jul* 44). Cæsar, apparently, had planned a system of public libraries, and placed the execution of this in the hands of the famous scholar, Varro. That Varro was enthusiastic in furtherance of the enterprise is indicated by the fact that one of his lost works was a treatise upon libraries and their development. It would seem that under Pollio the scheme finally assumed a definite form, and we know that in the library Varro was honored by the erection of a statue to him. Cæsar's dream of establishing a widespread system of libraries was in part realized by Augustus. Two new collections were founded by him in Rome: the Octavian and the Palatine, the former founded and named in honor of his sister, Octavia. This was housed in a splendid building constructed for the purpose. C. Melissus was the first librarian. The Palatine, according to Suetonius, was housed in two additions made to the temple of Apollo. “On either side of the Temple of Apollo stood libraries, one Greek and the other Latin, which contained none but works of special merit, with medallions of their authors embossed in either gold, silver or bronze.” (Consult Thomas, ‘Roman life under the Cæsars’). Of this Pompeius Macer was the first librarian, who was succeeded by Julius Hyginus. The Octavian Library was destroyed during the great fire which raged for three days during the reign of Titus (79 A.D). Records are extant of some 28 libraries in the Roman provinces and other dependencies of the empire, notably at Milan, Comum, Tibur, Potræ, Athens, Smyrna, Pompeii and Herculaneum. “There was moreover in Timgad a unique public library. It has been identified exactly through an inscription to the following effect: ‘Out of the funds bequeathed by Marcus Julius Quintianus Flavus Rogatianus, of Senatorial memory, by his will to the colony of Thamagudi, his mother city, the erection of a library has been completed at a cost of 400,000 sesterces, under the direction of the city authorities.’ The building in question consists of a rectangle of 77 by 80 feet, with recesses for receiving volumes or rolls of papyrus, with benches and seats for readers. There are also side rooms and evidently two upper galleries for book ‘stacks,’ the great central hall having a kind of skylight to facilitate reading. It seems to have been the custom in Rome as in America, for wealthy and distinguished citizens, Carnegie-like, to start the ball rolling, so to speak, in the matter of municipal libraries. We are reminded of the fact that the public library was a Roman institution, and that there were 28 public libraries in Rome in the 4th century. Some ingenious calculator has measured the space of the Timgad library, avowing that it contained at least 23,000 volumes.” (Consult Cooper, C. S., in *The Boston Transcript*, 2 Jan. 1918). Emperor Domitian expended vast sums in restoring the Roman libraries. He collected manuscripts from all parts of the empire, even sending scribes to Alexandria and other places to copy books when the originals themselves could not be obtained. Plutarch refers to a library founded by Octavia in memory of Marcellus, and Aulus Gellius to the collection in the palace of Tiberius, another in the temple of Peace, founded by Vespasian, and Dion Cassius gives an account of the famous Ulpian Library, founded by Trajan, which was first housed in the Forum of Trajan, but afterward transferred to the Baths of Diocletian. The library of Tiberius was burned in 191 A.D., during the reign of Commodus; the Palatine in the great conflagration of 363 A.D. (recorded by Ammianus Marcellinus, xxiii–3–3). That there were numberless private collections there can be no doubt. That of Lucullus has already been referred to, while Tyrannion, a Greek scholar captured by Lucullus in the Greek wars, was employed in arranging the library of Apellicon the Teian, seized by Sylla at Athens. This was, according to tradition, the original library of Aristotle which was hidden in the cave to prevent its falling into the hands of the king of Pergamus. (*Cf.* Plutarch, ‘Sylla’). Suidas asserts that Tyrannion formed a library of his own, numbering more than 30,000 rolls. This, however, may refer to the library of Apellicon. That Cicero was an ardent collector of books we know from many allusions in his writings, and Serenus Sammonicus, a physician of the 3d century A.D., possessed a library of 62,000 volumes. (Capitolinus, *Gord.* xviii, 2). The excavations of Pompeii and Herculaneum verify the fact that many residences had provision for libraries. In a few cases the cabinets and the rolls therein were still intact, from which a very accurate image of an ancient library has been obtained. The rolls were kept in cupboards (*armaria*) usually against the walls of the apartment, but sometimes detached. These were often elaborately decorated. As a guide to the contents of the different cases, the names of the authors were placed on the doors, sometimes surmounted by gold, silver or bronze medallion portraits. The walls of the room were often ornamented with frescoes or mosaics, statuary and other works of art. The public library doubtless had the same characteristics, but on a more extensive scale. Greek and Latin works were usually separated, the books in each division being subarranged according to subject: law, theology, philosophy, geography, medicine, *belles-lettres*, etc. Consult Cagnat, ‘Les bibliothèques municipales dans l'empire romain.’

Byzantine Empire.— The division of the empire was a serious blow to library development. Rome lost its interest in Greek literature and Constantinople cared little for the Latin. Furthermore, the spirit of the early Christians was opposed to the pagan writings, and many valuable collections were destroyed by narrow-minded fanatics. Constantine I is said to have possessed a royal library, but it could not have numbered more than a few hundred items, and those mainly theological. Julian, essentially a student and a lover of classic literature, is said to have added many books to the palace library, which numbered, according to some authorities, 120,000 volumes. This was burned by the iconoclasts during the reign of Leo the Isaurian (8th century), but later rebuilt. The Byzantine emperors of the 9th to the 11th century were patrons of learning and probably collected libraries. Little, however, is known about them. Under Leo Sapiens and Constantine Porphyrogenitus it is said that the libraries were restored, and undoubtedly



THE BRITISH MUSEUM, LONDON



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THE VATICAN LIBRARY, ROME

One of the richly decorated halls, 220 feet long. This stately hall is not the largest of the library rooms. In the Vatican Palace are 11,000 rooms and halls, and its library preserves some of the rarest and most valuable manuscripts and books in existence; these include a copy of Virgil 1600 years old; a copy of the Bible in Greek 1500 years old members of the Commenian dynasty found time in the midst of their intrigues to collect books.

Monastic Libraries.— The attitude of the early Fathers of the Church was rather inimical to any books save those of a religious nature, as has been indicated by the destruction of the Alexandrian libraries (q.v.) under Theophilus, archbishop of Alexandria, during the reign of Theodosius. This was owing to the fact that they were mainly pagan works. Soon, however, a body of Christian literature arose, and it was not long before the churchmen became as ardent collectors of books as their predecessors. Each monastery had its *archivum*, as had many churches. Skilful copyists were employed in transcribing religious books. According to the Theodosian Code, seven copyists were attached to the library at Constantinople. The Basilica at Cæsarea, founded by Pamphilus (A.D. 309), contained about 30,000 volumes.

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LIBRARIES, Mediæval and Renaissance. —With the disruption of the Western Empire, learning passed into eclipse. It is impossible to estimate what has been lost to the world during that period of political and intellectual twilight. What was saved was saved by monasteries, for they became the refuge of both scholars and books. Thus Cassiodorus, the favorite minister of Theodoric the Goth, gathered a collection of books and retired to a monastery at Viviers which he had founded, endowing it with money and with his library. Numberless monasteries sprang up in Asia Minor and Egypt, their collections lost to the world until the researches of Tattam, Curzon and others brought them again to light. The majority of their books and manuscripts were theological, but many of these were of great importance, comprehending versions of the Gospels and books of the Old Testament in Greek, Hebrew, Coptic and Syriac, and also texts of ancient classics and palimpsests that have revealed productions of the writers of antiquity that otherwise would have been wholly lost. During the 6th century, it is said at the instance of Gregory the Great, missionaries, among them Augustine, went to the British Isles. Soon monasteries sprang up there which became great centres of learning. Canterbury was founded, and to this went Theodore of Tarsus with books obtained in Rome for its library. A library was also founded at York by Archbishop Egbert, of which Alcuin made use when there, and the lack of which he bemoaned when, at the solicitation of Charlemagne, he became abbot of Tours. In the north of England, Jarrow and Whitby, the home of the Abbess Hilda and the poet Caedmon, both possessed libraries, that of the latter monastery being catalogued in the 12th century. Many of these monasteries were destroyed during the raids of the Danes, and their treasures were finally scattered as the result of the decrees of Henry VIII. The library at Christ Church Monastery, Canterbury, which was one of those to suffer at the hands of the Danes, was restored in the 11th century by Lanfranc and Anselm. A catalogue made during the 13th century contains 698 titles, about 3,000 volumes. Consult Edwards, 'Memoirs of libraries' (Vol. I, p. 122). A catalogue of Saint Augustine's Monastery at Canterbury has also been preserved, revealing that it was rich in historical works and in French romances. According to Baeda, the first abbot of Wearmouth, Bennet Biscop, made five journeys to Rome, each time bringing back books for the abbeys of Wearmouth and Jarrow. The collection at Wearmouth was cherished and increased by Baeda himself until it became the largest in England. It was destroyed by the Danes in 867, and Jarrow in 973. Croyland Monastery also possessed 700 volumes which were destroyed by fire in 1091. The monastery of Glastonbury, famous for its connection with the Arthurian cycle of legends, was ravaged by the Danes, splendidly rebuilt by Henry II and finally destroyed in the reign of Henry VIII. A catalogue of its collections (circa 1248) is contained in Hearne's edition of John of Glastonbury. A catalogue of the Peterborough Monastery library (14th century) reveals that it possessed 344 volumes and the Surtees Society has published lists of the books in the Durham Monastery. On the Continent, Charlemagne was the first of the Frankish kings to encourage learning and formed a collection of books for his palace. He also encouraged the establishment of other libraries. His son, Louis, formed a library which was extant during the time of Charles the Bald. Everhard, Count of Triuli, formed a collection which was later bequeathed to a monastery. The greatest private collector of the 11th century, however, was Gerbert, afterward Pope Sylvester II, who spent large sums in developing his collections. The Benedictine Order was undoubtedly the most active in the cause of learning in western Europe, and its monasteries gathered large and valuable libraries. The oldest of the foundations, Monte Cassino (A.D. 529), was the beginning of a long line of institutions, among which may be named Fleury, Moelk, Saint Gall, Saint Vast, the famous Saint Maur; the English monasteries of Jarrow, Wearmouth, Bury Saint Edmunds, Croyland, Glastonbury, Whitby, Reading, Saint Albans and Tewkesbury.

The Augustinians and Dominicans rank next to the Benedictines as lovers of books. Saint Geneviève and Saint Victor had large libraries. The Barefoot Friars and other mendicant orders also collected books in their travels. Richard of Bury, the founder of a library at Oxford and the author of 'Philobiblon,' a treatise on the art of collecting and preserving books, praised their enthusiasm and industry, and Sir Richard Whittington (d. 1423) built a library for them at Grey Friars, London. In France, monasteries at Fleury, Cluny, Corbie and Saint Riquier possessed libraries. After suffering many vicissitudes the remnant of the Fleury collection was presented to the town library of Orleans (1793). From the Corbie Monastery 400 MSS. were transferred to Saint Germain des Prés in 1638, and in 1794 the remainder was divided between the Bibliothèque Nationale and the town library of Amiens. In Germany the monasteries of Fulda, Corvey, Richenau and Sponheim had excellent collections. At Fulda, it is said that 400 copyists were busy at one time. Sponheim is famous because of its Abbott, Johannes Trithemius, who established its library. The monastic library of Saint Gall, in Switzerland, founded by its abbott, Gozbert, is still extant. Several general catalogues of monastic libraries have been compiled, the first being one by the Franciscans (14th century), a sort of union catalogue of 160 European libraries. In the early 15th century John Boston of Bury, an Augustinian monk, made a list of the books in 195 British libraries, each collection being designated by a number, making, as John Bale says, «one library out of many» (cf. Tanner's 'Bibliotheca,' 1748, pp. xviii–xliiii). John Leland, 1506?–52, the famous antiquarian and librarian of Henry VIII, made notes of the collections in the institutions of England visited in the years 1536–42. These lists are contained in the edition of Leland published by Hearne in 1715.

Renaissance Libraries.—The lamp of learning which had burned during the 8th to 10th centuries and had become almost extinguished during the period following the Crusades, flames up again during the 12th–13th centuries, the age of the cathedral builders, and again dies down, not to revive until the 15th century. In England the barbaric invaders from Denmark and Norway had applied the torch to Wearmouth, Jarrow, Whitby and other of Britain's noblest foundations, and the institutions spared by the Danes suffered from fires or from accumulated wealth. Here, and on the Continent, the interest in learning passed into decay, and the monasteries that had been preservers of books now became their tombs. Boccaccio, in an account of a visit to the Abbey of Monte Cassino, vividly describes the condition of its precious manuscripts «personifying them as gentle prisoners held in captivity by barbarous jailers.» Poggio, who made a journey to the Council of Constance as Apostolic Secretary, also states that the manuscripts in the Abbey of Saint Gall were kept in «a dungeon foul and dark, at the bottom of a tower.» (Consult 'Cambridge Modern History,' Vol. I, p. 549). Here and there were free spirits among men, like Pope Sylvester II, who fought against the moral and mental negation of the times, and endeavored to maintain the traditions of learning, yet scholarship, save among the Arabs, was at a discount. It was not until the 15th century that a new light was kindled by Petrarch, Poggio and Boccaccio, and the revival of learning began. Stimulated by their example, a world-wide and almost mad search for classic texts began. Palimpsests were discovered and their concealed writings brought to light. The Medici family, in particular, was keenly interested in learning, and in founding libraries. Cosmo de Medici, while an exile in Venice (1433), founded the library of San Giorgio Maggiore, and later, after his return to Florence, was made one of the trustees of the collection of 800 MSS. collected and copied by Niccolo de' Niccoli. Four hundred of these were presented to the library of the Convent of San Marco (1441), the remaining 400 passing into his own collection, thus forming the nucleus of the Medicean Library. This joined later with the collection of San Marco, and that of Fiesole, also founded by him, now form a part of the Biblioteca Medicio—Laurenziana. In this work for libraries the Medici found an able helper in Vespasiano de Bisticci (1421–98) who might well be termed the father of Italian libraries. Vespasiano also assisted Federigo de' Montefeltro, Duke of Urbino, in creating his splendid collection of classics, theology, medicine and humanistic literature. Vespasiano tells us that he kept a large staff of scribes at work for 14 years transcribing material. Few of the collections rivalled those of Federigo, but there were other large ones, particularly that of Cardinal Bessarion, which, according to Vespasiano, contained 600 Greek and Latin manuscripts. This was presented to San Marco Cathedral, Venice, in 1468, but a generation passed before it was properly housed. The Vatican Library (q.v.) as now constituted also dates from the 15th century. Earlier collections had been formed by the popes, but it was not until Nicholas V (1447–55) filled the chair that the library received any special attention. The Pope, who as Tommaso Parentucelli, had been librarian of San Marco, Florence, had perhaps imbibed some of the enthusiasm of Vespasiano and the Medici. At any rate the library was greatly increased by him and his immediate successors, being housed finally in the splendid apartment in the Vatican (1475). In manuscripts, the Vatican collections are perhaps the richest in the world, many of the items being unique. They number about 34,000. The Humanistic movement spread rapidly over Europe and many private collections of books were developed. Among these collectors, John Bale and John Leland in England have already been mentioned, as has Trithemius, the work of the latter being continued by Cardinal Bellarmine in Italy. Matthias Corvinus, king of Hungary, formed a splendid library, mainly manuscripts, which is said to have numbered 50,000 items. This was dispersed by the Turks after the fall of Buda, 1526. The kings of France, particularly Saint Louis, Charles V and Francis I, encouraged the book arts in their every phase. It has been noted how the religious institutions were the conservers of learning during the Dark Ages and the Mediæval Period, only to become their tombs or to be destroyed during the events of the religious wars. Eight hundred, it is said, disappeared at this time. Another group of institutions, however, now appeared to play the rôle of the builders of libraries These were the universities. Even before the period of Renaissance the universities under direction of the Church had become centres of cultural activity. They sprang into existence throughout Europe, especially in France, Germany and Italy. Among these might be noted Paris, Poitiers, Caen, Bordeaux, Nantes, Pisa, Florence, Bologna, Padua, Constance, Basel, Heidelberg, Cologne, Frankfort-on-Oder, Prague, Louvain, Utrecht, etc. In spite of the fact that theology was the main concern of these institutions, nevertheless they were forums of free discussion, collectors of literature, and presented a strong front against arbitrary restrictions upon their prerogatives. Courses in physical science were offered, and books were gathered. «John of Dalberg, appointed in 1482 Curator of Heidelberg and Bishop of Worms, divided his time between the University and the bishopric; he helped to establish the first chair of Greek, and founded the famous Palatine library. Reuchlin came to Heidelberg in 1496; he was made librarian and in 1498 professor of Hebrew.» (Consult 'Cambridge Modern History,' Vol. I, p. 637). The invention of printing gave a

CONGRESSIONAL LIBRARY, WASHINGTON, D. C.

Public Library of the City of Chicago

Central Library Building of the City of Boston tremendous impetus to the making and the collecting of books. They became so inexpensive that many printed works could be obtained at the cost of one manuscript. Libraries accordingly began to increase rapidly in numbers, and in the size of their collections. The breakdown, of mediæval institutions, the decline in power of the Holy Roman Empire, and the strengthening of the principle of nationality were also influences that encouraged the development of libraries within the different states of Europe. For this reason their history after the beginning of the modern era can best be told separately.

EDWIN WILEY,
Librarian, United States Naval War College.

LIBRARIES, Modern. The origin and history of the modern libraries of the world will here be treated under the captions of the various nations as best suited to clearness and the purposes of an encyclopædia.

UNITED STATES.

Origins.— Library history in America begins with the first permanent settlement in the New World by the English. At Jamestown it was proposed to establish a college, and the minutes of the Virginia Company record a gift of books to the institution. The Indian massacre of 1622, however, dissipated these plans. New England was more fortunate. Harvard College was founded in 1636, and two years later, under the terms of the will of Rev. John Harvard, the school became possessed of 300 books. An interesting chapter in early American library history was the effort of the Rev. Thomas Bray of England to establish parochial libraries in Great Britain and the colonies. In 1699, he arrived at Baltimore and established soon after a number of such collections. These libraries, with the exception of a few volumes, have disappeared, but some of the English collections are still extant. Among other libraries founded during 17th century, William and Mary College (1692) and the Yale College (1700) are still in existence, Yale Library numbering now about 1,025,000 volumes.

Subscription and Shareholding Libraries of the 18th Century.—The 18th century marked the origin and development of the library as an independent institution. This was due to the founding of subscription or shareholding libraries. The influence of these was, of course, restricted to the members, but even so they constituted an important advance toward the modern free library. The founding of the earliest of these, the Library Company of Philadelphia (1732), was one of the multifarious activities of Benjamin Franklin. It was an outgrowth of a literary society, first called the «Junto,» which became eventually the American Philosophical Society. In 1769 the Union Library Company, and, in 1771, the Association and Amicable Library Companies were merged with the Philadelphia Library. A still more important accession was the Loganian Library (1792), which had developed from the private collections of James Logan, formerly a private secretary of William Penn. Other libraries of this type organized during the 18th century were the Redwood Library, Newport (1747), the first institution in America to erect a building solely for library purposes, which is still standing; the Charlestown, S. C., Library (1748); the New York Society Library (1754); the Providence Library (1758), and the Baltimore Library Association (1795).

Athenæums, Mercantile and Apprentice Libraries.— A further advance toward the popularization of the library idea was the organization and development of athenæums, mercantile and apprentice libraries. A few of first group, of which the Boston Athenæum (1807) is the best example, were closely allied with the subscription libraries, yet the majority of the athenæums such as the Salem (1810), the Rochester, N. Y. (1829), the Providence Athenæum (1753), the Lancaster Athenæum (1860) and others partook more of the nature of mercantile libraries. Mercantile libraries were organized in Boston (1820), New York (1820), Philadelphia (1821), Albany (1833), Cincinnati (1835), Baltimore (1839), San Francisco (1853). There were, approximately, 67 libraries of the mercantile-mechanics type established before 1870. Still more popular in nature were the apprentice libraries, organized for the welfare of young men. A few of these were founded prior to the 19th century; one at Charleston, S. C., another at Lexington, Ky., and one at Newport, R. I.

It is not strange, therefore, that in some cities these libraries for many years performed the functions of the public library. Their fees were low, and social considerations played little part in the selection of their clientele, hence the growth and great educational influence of such libraries as the Boston, the New York, the Philadelphia and the San Francisco mercantile libraries.

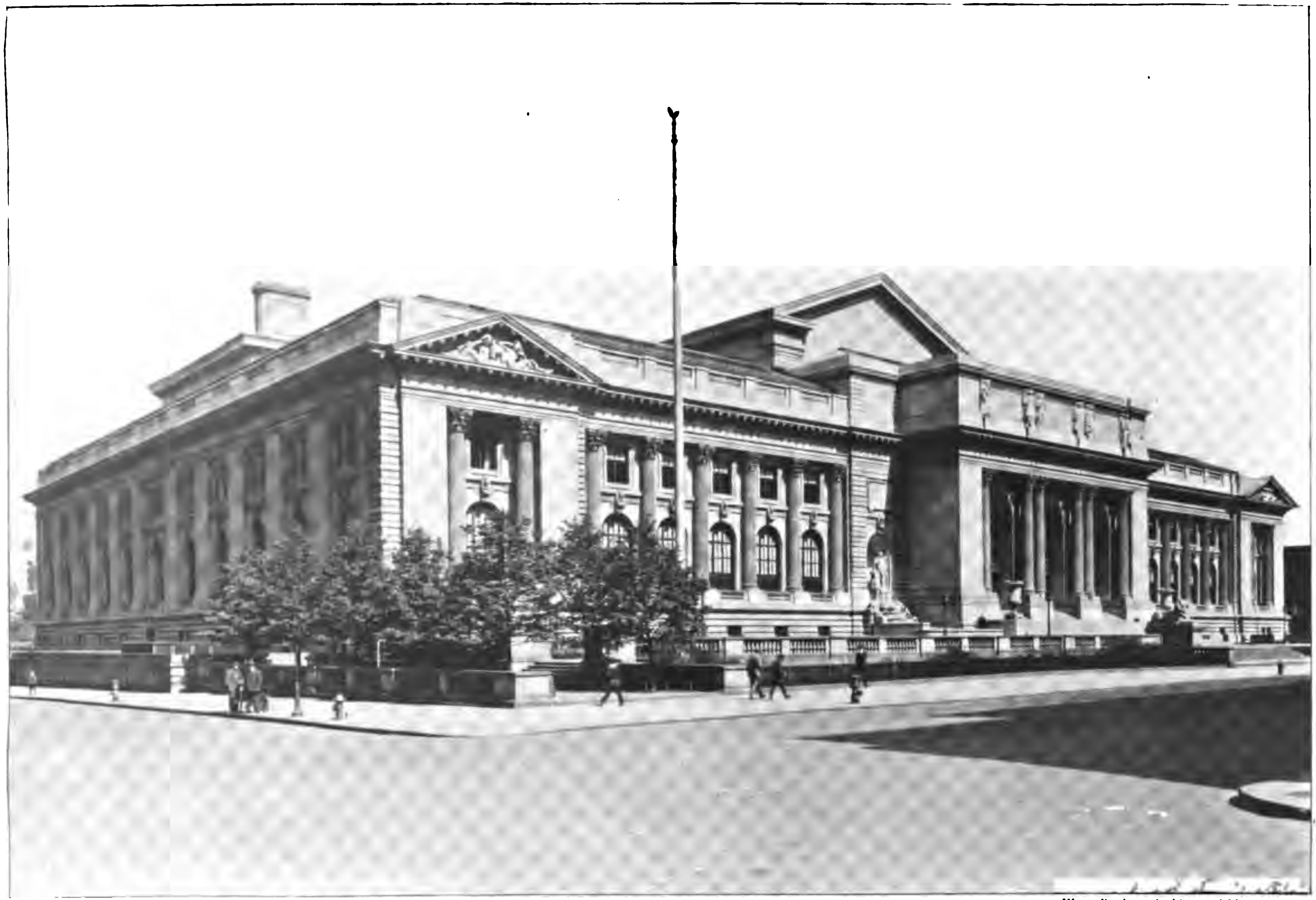
Growth of the Idea of the Free Public Library.— This popularization of the shareholding library, however, did not go far enough. It did not respond fully to American educational demands, and as a result the idea of a free public library began to assume form. Already the public school had been established and had proved its worth, and the time was ripe for its corollary, the free public library. Many years before, far-seeing men like Franklin and Jefferson perceived the value and need of such institutions, yet it was not until the middle of the 19th century that the movement gained strength. No account of the development of public libraries in America can omit reference to Prof. Charles C. Jewett, librarian of the Smithsonian Institution and later of the Boston Public Library. He can justly be termed the father of the modern library movement in America, for it was his broad vision of the importance of the library in the community, of the need for library co-operation, and his enthusiasm that bore fruit first in a conference of American librarians in 1853, which ultimately resulted in the organization of the American Library Association, and the founding of *The Library Journal* in 1876. The work he had initiated was at this time carried to success by Winsor, Poole, Dewey, Cutter, Spofford, Billings, Greene, Leypoldt, Bowker, Putnam and other pioneers in American library work.

Library Philanthropy.— Coincident with this awakening of librarians to the value and tremendous possibilities of their profession, there was an awakening on the part of men of wealth to a new and singularly productive field of philanthropy. Already John Jacob Astor (1849) and James Lenox (1870) had founded in New York city the institutions bearing their names; Joshua Bates of London had made munificent gifts to the Boston Public Library; the Newberry bequest had just fallen to the citizens of Chicago (1876); Dr. B. Rush had left $1,000,000 for the erection of the Ridgeway Branch of the Philadelphia Public Library; and James Lick had made gifts to the libraries of San Francisco. Now, however, began an era of gifts to American libraries that have totaled astounding figures, Andrew Carnegie, alone, giving $64,000,000, the terms of his gifts making it possible for nearly any community willing to support and develop it to have a library. State and municipal aid have also entered strongly into this great expansion of library activity, and more and more rapidly is the ideal aim of placing books freely within reach of all is being realized, even in the remote districts of mountain and prairie. This has meant a complete transformation of the whole concept of the library. Formerly it was only a conserver of knowledge, a mere storehouse of books, now it realizes its true destiny by becoming a vital and progressive force in its community, reaching out and inviting all to share in its treasures. The library thus becomes an active and not a passive agency, joining with and supplementing the schools and other institutions. It becomes, in reality, a continuing university, free to all and supported by all. The support that has been given libraries by the communities and by the States is a very tangible recognition of the popular esteem in which libraries are held. Library enabling laws have been enacted by nearly every State in the Union, and under their provisions nearly any community may establish a public library and tax itself for its maintenance. These laws are usually permissive, yet the opportunity they offer has been generously seized upon. Local control is also universal, authority being invested in boards of trustees who determine the policy and expenditures of the institution. In addition many States have library commissions, which as a rule have advisory jurisdiction, but in certain instances, such as California, actively administer a widely extended system of State libraries. Traveling library systems have also been established in various States. These are generally under direction of the State library commission. The activities of American public libraries are protean, only a few of which can be pointed out. They work hand in hand with the schools, often maintaining branches in the latter; they use every means to get in touch with the child and encourage him to read good books; they reach out to the immigrant, offering him books in his own language but at the same time endeavor to introduce him to the language and ideals of his adopted country; they endeavor to supply the needs of the business men, manufacturer, etc., building up collections, as at Grand Rapids, relating to the peculiar industries of the region; they keep in touch with the work of the clubs and associations and supply as far as possible their bibliographic necessities; they offer lecture courses. These are a few of the manifold phases of the work of the modern library that have been superimposed upon the original idea of the library as a mere storehouse of books.

The First Free Public Libraries in America.— It is almost impossible to determine the identity of the first library in the United States supported by public funds and wholly free to its users. The earliest recorded gift of books to a municipality is that of the Rev. John Sharp who bequeathed, in 1700, his library to the city of New York for the benefit of the people. This has disappeared, as has another collection founded in 1803 at Salisbury, Conn. The Town Library at Petersborough, N. H., founded through the efforts of Rev. Abiel Abbot in 1833, appears, from the data at hand, to have been the first free library which has continued to the present. This, however, was essentially a local development, and the movement in its larger aspects was probably initiated by the enactment of a law in 1848 enabling Boston to establish a free public library. In 1851 this was extended to the whole State. The Boston Public Library is thus one of the first American free public libraries in time and for many years it was the first in importance, taking second place only to the New York Public Library after the merger of its various foundations, the New York Public Library (q.v.) becoming thereby the greatest institution of the kind in the world. This primacy of the Boston Library comprehended not only the extent and scope of its collections, but also building, librarians and general cultural activities. The first home of the library, built according to the discarded alcove plan, was nevertheless for many years the most imposing public library building in the country, a position that was regained when the new structure was erected at Copley Square in 1895, at a total cost of $2,750,000. This beautiful Renaissance building, with its mural decorations by Abbey, Sargent and other distinguished artists, was the forerunner of the great library constructions of to-day, few of which have surpassed it in dignity and fitness. The Boston Public Library has 30 branches and contains collections totalling 1,157,326 volumes.

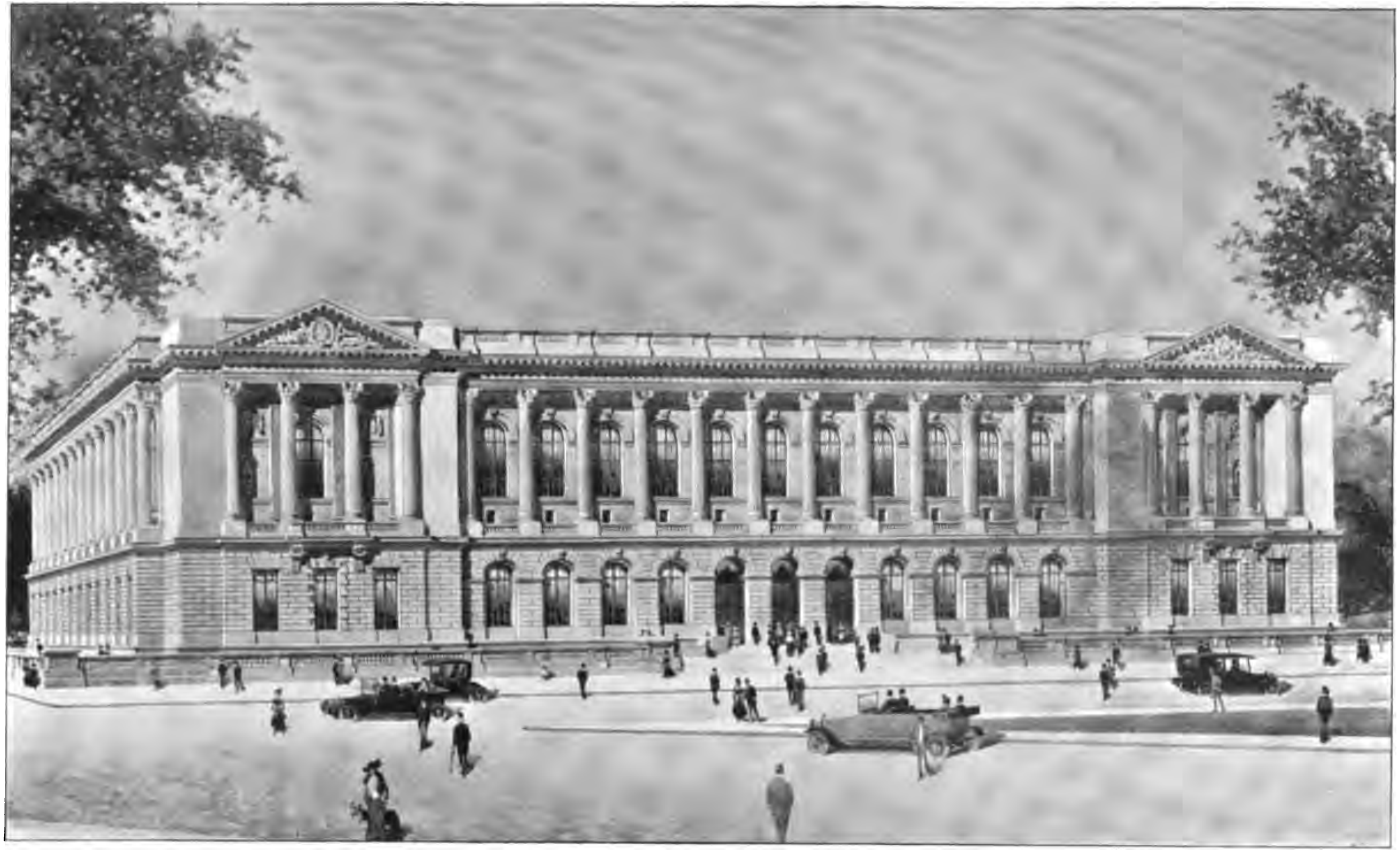
The Chicago Public Library assumes a position next to that of the Boston and New York libraries, but differs from them to the extent that it is, in fact, as well as in name, a popular library. Its collections are restricted in the main to books that would be called for by the general public and not by the scholar; the student of literature and the humanities being left to the Newberry, and the one in science and the useful arts to the John Crerar. The same principle applies to the building, which is an imposing but simple Renaissance structure, the idea of fitness for use being uppermost. This building was erected in 1898. It is an interesting fact that the Chicago Library originated in a gift of 7,000 books gathered in England by Thomas Hughes, the author of ‘Tom Brown at Rugby,’ and presented to the people of the city after the great fire of 1871. This humble nucleus has grown into a collection of about 800,000 volumes distributed through the central library and its 45 branches.

Another public library that supplies a great constituency most efficiently is the Saint Louis Public Library. This was established in 1893, being a merger of several earlier collections, the most important of which was the Public School Library founded in 1860 by Ira Divoll,



Wurts Brothers, Architectural Photographers

THE NEW YORK PUBLIC LIBRARY



PHILADELPHIA PUBLIC FREE LIBRARY

then superintendent of public schools. It was further developed by Dr. W. T. Harris, and by the remarkable group of thinkers then in Saint Louis. It is at present housed in a beautiful building, completed in 1912 at a cost of $1,900,000. The collections number 487,330 volumes distributed through the central building and seven branches.

Another city library formed of smaller collections and now occupying an attractive new building is the Denver Public Library. This was formed by an amalgamation of the Denver Public Library, housed in the East Denver High School, and the Mercantile Library. It has four branches in addition to the central building with collections numbering 192,366 volumes. Mr. Carnegie's gifts have aided the larger libraries as well as the smaller ones, the most notable gift being the sum of $5,200,000 to construct branch library buildings for the New York Public Library. Toward the construction of central libraries, however, among the many, may be noted the beautiful building of the District of Columbia Library, founded in 1896. Its collections number about 200,000 volumes. Another splendidly vital library, almost wholly due to his munificence, is the Carnegie Library of Pittsburgh (1895) with eight branches and 434,469 volumes. The Louisville Public Library building was also constructed with Carnegie funds ($250,000), to which he later added $200,000 for eight branch libraries. Two of these branches were constructed for the colored people of the city. Nearly all the libraries in the Southern States, in fact, have branches of this type. Among the other public libraries of the country worthy of much fuller attention are Brookline, Mass. (4 branches, 90,000 vols.); Cambridge (1858; 5 branches, 113,314 vols.); Somerville (3 branches, 115,216 vols.); Springfield (1857; 3 branches, 229,990 vols.); Worcester (3 branches, 244,047 vols.); Providence (1878; 4 branches, 181,307 vols.); Hartford (2 branches, 118,000 vols.); Philadelphia (1891; 26 branches, 534,152 vols.); Buffalo (1836; 7 branches, 363,546 vols.); Cleveland (1867; 44 branches, 584,340 vols.); Brooklyn (33 branches, 862,112 vols.); Pratt Institute, Brooklyn (1888; 114,775 vols.); Newark (1889; 3 branches, 256,581 vols.); Enoch Pratt, Baltimore (1886; 16 branches, 355,817 vols.); Cincinnati (1814; 24 branches, 515,906 vols.); Detroit (1865; 13 branches, 450,910 vols.); Milwaukee (10 branches, 342,194 vols.); Minneapolis (1889; 15 branches, 334,763 vols.); Saint Paul (4 branches, 161,609 vols.); Grand Rapids (1837; 13 branches, 147,761 vols.); Kansas City (12 branches, 271,077 vols.); Los Angeles (1872; 19 branches, 309,463 vols.); Cossitt Library (Memphis 1888; 8 branches, 120,263 vols.); New Orleans (1897; 4 branches, 102,927 vols.); Atlanta (1899; 4 branches, 94,770 vols.).

College and University Libraries.— In point of time the college and university libraries antedated the other types, and while they have developed to an amazing extent yet the growth of each collection has been determined by the character and demands of the institution of which it forms a part. The collegiate library must co-ordinate its activities with those of its school, forming, as it were, a sort of bibliographic laboratory. During recent years the conception that the library was but a storehouse of reference and source material has given way in some cases to a separation of the different groups of books, each group assigned to the care of the academic department most interested. This method was extensively tried out at Johns Hopkins and Chicago universities, but the difficulties of administration, the overlapping of interests and the irregular development of collections has forced the return to the idea of the central library, the principle of the seminary or special departmental libraries being adhered to, yet restricted in scope and usually under control of the university librarian. Hence seminary libraries are to be found in practically every university in the country, some of them constituting special collections of the highest value.

It has already been noted that all that is known of the College of Henrico is the brief notice regarding its gift of books. The experience of Harvard, however, was not so unfortunate. By the death of the Rev. John Harvard in 1638 the college came into possession of a collection of about 370 volumes, mainly theological. These were added to, until the library at the end of a century contained some 5,000 volumes, the largest collegiate collection in America. In 1764, however, this was destroyed by fire, only a few hundred books being rescued. Steps to reconstitute the library were immediately taken and in 1790 its collections numbered about 12,000; in 1840, 40,000; in 1856, 70,000 volumes and 30,000 pamphlets; in 1875, 154,000 volumes; the aggregate number of volumes of the various libraries of Harvard being 227,650 volumes. The main library now numbers 792,117 and all the libraries total 1,088,000. In 1840 the collections were moved into the Gore Hall, at that time considered adequate for the growth of many years. Nevertheless owing to the rapid growth of the library it has long been inadequate, making the necessity for a new building imperative, which was realized in 1907 by the bequest of the late Harry Elkins Widener, who also donated to the library a splendid collection of book rarities.

William and Mary College, founded in 1692 under the auspices of the Church of England, was long the wealthiest institution in the colonies. It is known to have possessed books from its beginning, though doubtless the collection was small. It, too, suffered from fire in 1705, but its collections were replenished by gifts from the mother country and from France, Queen Anne, the Georges and Louis XV being numbered among the donors of books. The college went into eclipse during the Civil War and it is only recently that it has again begun to take its place among the schools of the country.

It seems that Yale had a library provided for it before its foundation in 1700, for gifts of books had been made in anticipation of the establishment of a school in Connecticut. In 1765 the collection comprehended 4,000 volumes; in 1808, 4,700 volumes; 1913, 1,000,000 volumes; the total collections of Yale now aggregating 1,025,000 volumes.

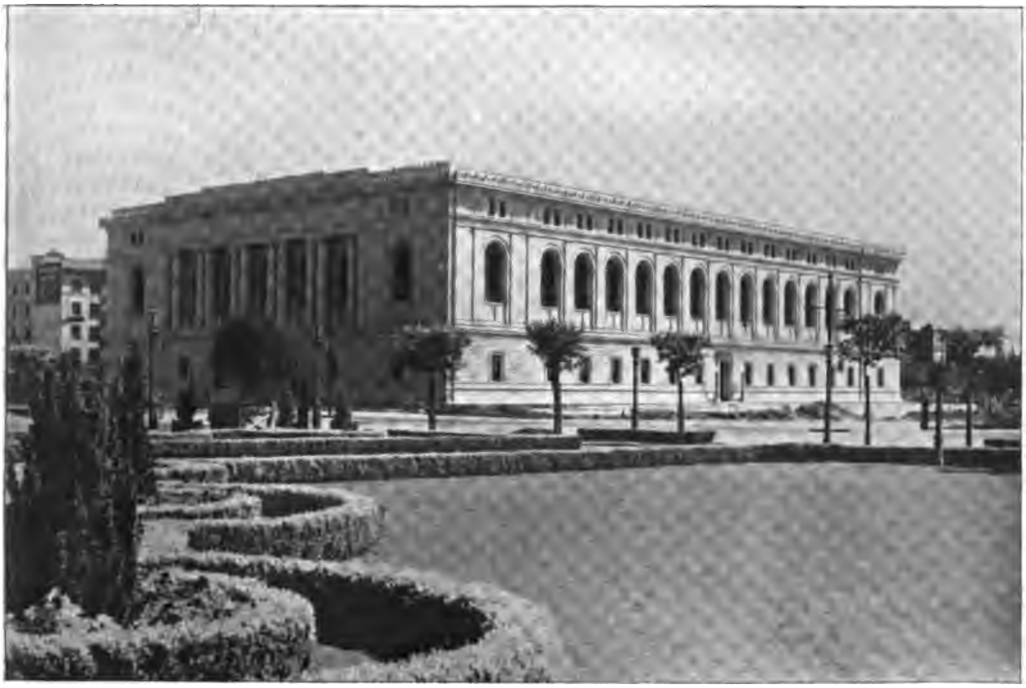
During the first half of the 19th century a movement was well under way that forms a most important chapter in American educational and library history. This was the establishment of State universities. The national policy of permitting the States to handle their educational problems in their own way has resulted in an unequal, but on the whole a remarkable, development of institutions of learning. Some universities, Harvard and Columbia for example, partook of the nature of State schools at an early date, which they have since lost, hence it remained for the University of Virginia, which sprang to the last detail from the mind of Thomas Jefferson, to be the forerunner and model of succeeding foundations. Jefferson correctly estimated the importance of the library in the scheme of a university, and all of his plans for the school centred around that fact. Hence when the university set to work in 1825 the library building was not only complete but a collection of books, selected by him, was on the way from Europe. It may be noted that this central library building and the funds for equipping it were only obtained after a bitter struggle with short-sighted politicians and reactionaries. As might be surmised, in founding this institution Jefferson was profoundly influenced by English and French models, and the university in turn has transmitted the educational principles of its founder to many other schools in the South and Southwest. That it has been outstripped by some of these has been due to conditions that need not be discussed, one of which, the burning of the Rotunda, or library building, in 1895, was a positive disaster from which the library has not yet recovered, although the building was immediately reconstructed.

University Libraries in the South.— Perhaps it was due to the influence of Virginia that the idea of the State university was first accepted in the Southern States. At any rate it was in these States that for decades they were the most important institutions of higher education. Each one of them possessed some sort of a library, many of which collections were destroyed during the Civil War and are only now taking place with the other collections of the country. Among these may be noted the University of North Carolina (1795; 79,205 vols.); South Carolina (1805; 46,000 vols.); Georgia (1800; 41,000 vols.); Tennessee (1796: 37,379 vols.).

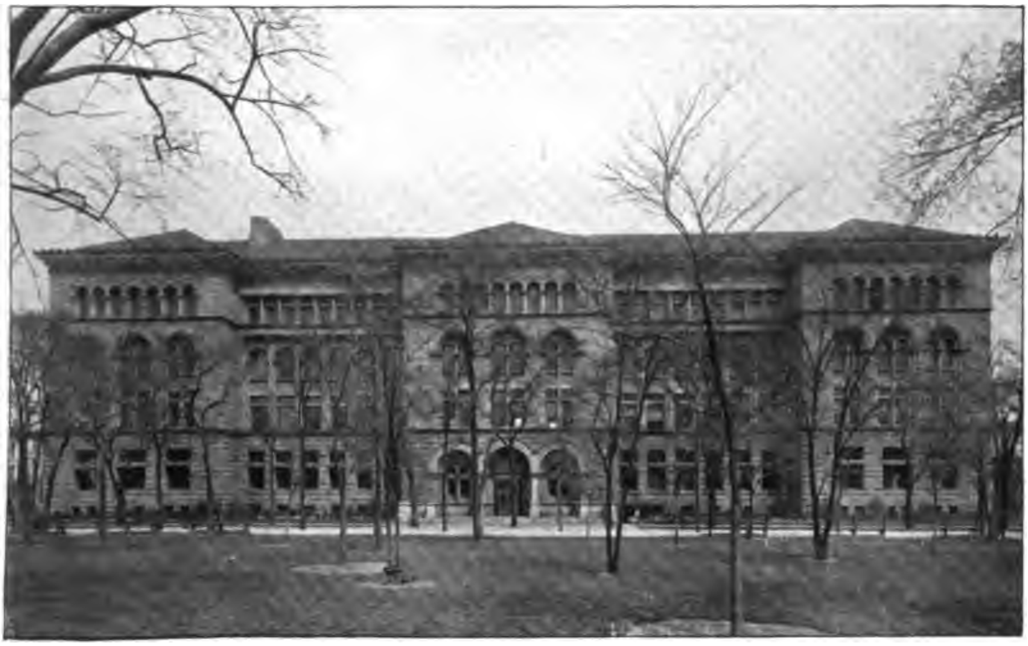
University Libraries in the West.— During the middle of the 19th century, the Middle and Far West had developed to such an extent that the demand of the people for schools and libraries began to find response and then began a most remarkable development in these fields. The earliest of these educational institutions, the University of Missouri (1841; 161,470 vols.), owed more to Southern influences than Northern, as did the University of Texas (1836; 134,342 vols.), hence it is in the University of Michigan (1837; 383,976 vols.) that we find the earliest type of the great universities that have sprung up throughout the West. Among these that have large libraries the following may be noted: California (1865; 355,463 vols.); Illinois (380,000 vols.); Iowa (1850; 130,040 vols.); Minnesota (1867; 251,000 vols.); Nebraska (1871; 138,650 vols.); Ohio (1873; 176,526 vols.); Wisconsin (1849; 255,000 vols.).

Privately Endowed Universities.— Equally important has been the development of libraries of institutions owing their origin wholly or in part to private munificence. One of the earliest of these, Cornell (1868), has a library of 489,656 volumes; Lehigh (1877), 130,000; Leland Stanford (1891), 287,634. The growth of the libraries of these schools has been relatively moderate compared with that of the University of Chicago founded in 1892 by John D. Rockefeller, its collections growing from nothing to half a million volumes in 25 years. Other colleges and universities having collections of more than 100,000 volumes are: Dartmouth (1769), 140,000; Georgetown (1789), 106,341; Bowdoin (1794), 115,789; Amherst (1821), 118,000; Oberlin (1833), 175,625; Johns Hopkins (1876), 202,247; Princeton (1746), 397,126 volumes. The character of a college library is determined, of course, by the nature and aims of its institution. In schools mainly technological, like Lehigh, Cornell or Massachusetts Institute of Technology, the collections are strongly scientific or technical. The same is true of many of the libraries of the State universities, the latter often specializing in agriculture and kindred topics.

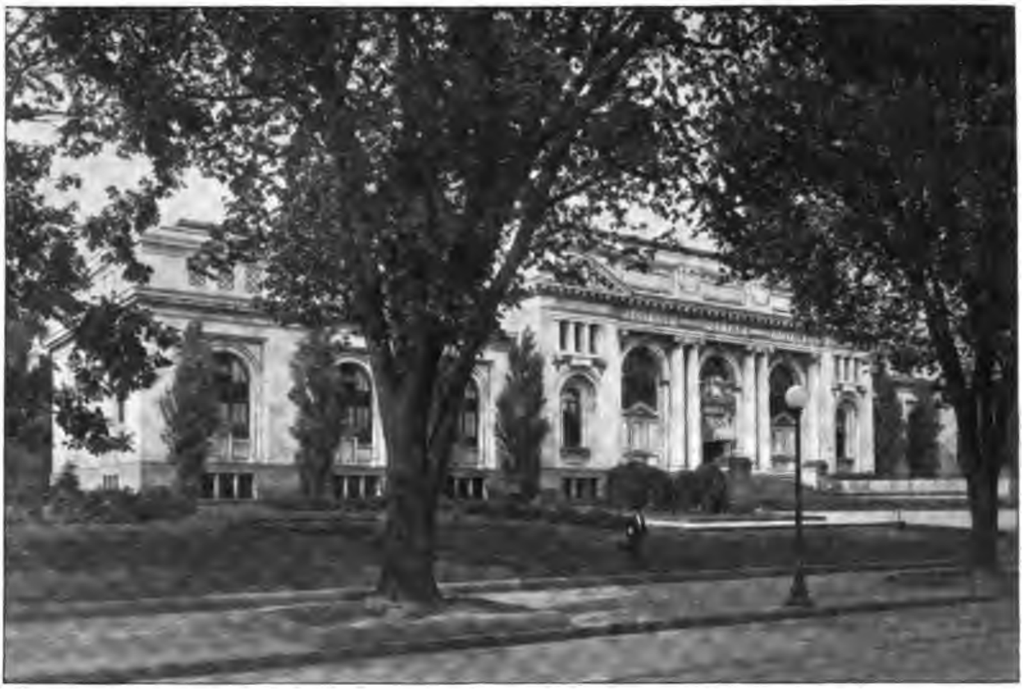
State Libraries.—Another and relatively early development of libraries in the United States was that of the State libraries. Originally these were merely reference collections, mainly law books and public documents, housed in the State capitol. In time, however, many of these collections quite outgrew their limitations, becoming general libraries, the most of them remaining essentially reference collections. A few like the New York and California State libraries in addition serve as capstones to splendidly organized State library systems. In general, the funds for the maintenance and development of these institutions are supplied by appropriations from the State treasuries, which, it must be confessed, have not always been sufficiently generous to warrant large extensions of their activities. A few of the larger State libraries, such as that of Massachusetts, of Connecticut and of Arkansas, still adhere to the law and document principle, whereas in the case of Colorado, Illinois, Ohio, Oregon, Rhode Island, Texas and Virginia the State library has developed into a general or historical collection which had resulted in the establishment of special law or reference libraries for official use. In 1811 the State Library of Massachusetts initiated the custom of exchanging State documents which it has kept up to the present. It is difficult to say which State had the earliest collection. Pennsylvania is said to have had an official library in 1777 and New Hampshire claims to have possessed one prior to the Revolution. In some cases the libraries had developed before any official recognition was made of them. Thus Virginia appointed a State librarian in 1825, before an appropriation had been made for books, and Tennessee had accumulated some 8,000 volumes prior to the first official enactment regarding the collection in 1854. The following are the most important State libraries: Arkansas (1836), 100,000 volumes; California (1850), 207,283; Connecticut (1835), 200,000 (law); Iowa (1846), 142,841, Kentucky (1820), 116,626; Maine (1820), 110,000; Massachusetts (1826), 192,015 (law); New Hampshire (1820), 153,861; New York (1818), 449,542; Ohio (1817), 213,723; Pennsylvania (1816), 176,624; Tennessee (1854), 150,000; Virginia (1823), 114,520. In addition, Louisiana, Georgia, Maine, Maryland, Minnesota, New Jersey and Nebraska have State law libraries, and Colorado, Illinois and Ohio have Supreme Court libraries.



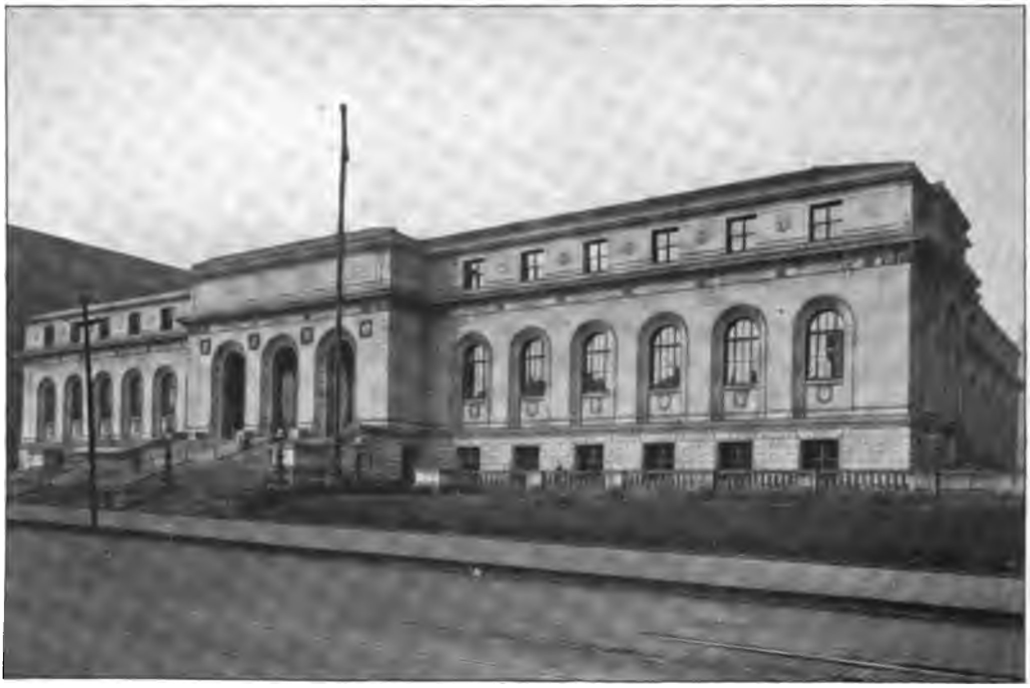
San Francisco Public Library



Newberry Library, Chicago



The Public Library of the District of Columbia, Washington, D. C.



Saint Louis Public Library, Saint Louis, Mo.

Special Libraries.— The development of the special library in the United States has assumed two phases which might be termed the early and the recent. The former comprehends the establishment and expansion of types of libraries already differentiated in Europe, such as theological, legal, medical, historical and, to a lesser degree, pedagogical and associational libraries. The second group is the result of the development of science during the 19th century, and of recent economic and social movements.

Theological Libraries.— The earliest of these were the theological libraries, the majority of which were developed in connection with institutions of learning. Indeed, some of the college libraries of the 18th century consisted mainly of theological literature. As the secular aspects of the institutions became more and more emphasized, the theological elements tended to become segregated, forming departments of the school, rather than permeations of the whole. The libraries followed this tendency hence we find the development of the splendid theological collections at Harvard, Princeton and other universities. The Harvard, now the Andover-Harvard Theological Library, numbers 109,321 volumes and the Princeton Theological Seminary Library 103,427 volumes. One of the few institutions whose library has remained true to the earlier type is the Georgetown University. Its collections consist to a large extent of Catholic theologic literature and number about 106,000 volumes. In addition to these university collections, the foundation of sectarian seminaries during the first half of the 19th century has resulted in the upbuilding of some very excellent special libraries of theology, such as the Union Theological Seminary (1835; 130,018 vols.); the Drew Theological Seminary (Methodist, 1867; 128,054 vols.); the Hartford Theological Seminary (1834; 109,620 vols.) and the General Theological Seminary (1817; 59,691 vols.).

Law Libraries.—Another early type of special libraries is the law library. These were first developed, as was the case of the theological libraries, in connection with colleges, the Harvard Law Library, housed in a splendid building of its own, still remaining one of the largest collections in America (172,073 volumes). Other colleges with special law libraries are Columbia (59,262 vols.), University of Chicago (40,236 vols.), Yale (40,127 vols.), Northwestern (45,000), New York University (25,791 vols.), University of Pennsylvania (57,152 vols.). Legal literature is predominant in the collections of State libraries, but as many of these have developed into general libraries, a number of States have developed in addition special legal libraries, among them being the Indiana State Law Library (55,000 vols.), Minnesota State Law Library (79,662 vols.), New York State Law Library (69,000 vols.), the Ohio Supreme Court Library (36,000 vols.). A few of the State libraries, such as the Massachusetts (192,015 vols.), remain essentially law and documentary libraries. In addition to these, bar associations and legal societies have organized and developed law collections, some of them of first importance such as that of the New York Association of the Bar (114,437 vols.), Philadelphia Law Association (62,858 vols.), Chicago Law Institute (67,072 vols.), Social Law Library, Boston (65,000 vols.), Bar Association of San Franciso (35,000 vols.), San Francisco Law Library (28,000 vols.), New York Law Institute (81,209 vols.).

Medical Libraries.— The literature of a science so progressive as that of medicine and its allied subjects loses its value after a very limited period, hence many of the books have little save historical interest. For this reason only a few institutions undertake to obtain and care for the great mass of medical lore of the past. This has been left to institutions with the necessary funds and facilities for its preservation. One library in particular in the United States has essayed to play this part with distinguished success — the Library of the Surgeon-General's office of the United States Army. Under direction of Dr. John S. Billings, the largest collection of medical literature in America has been gathered, classified and a catalogue issued that is a monument of bibliographic research. The library now numbers 190,310 bound volumes and 328,036 pamphlets. The majority of the medical libraries are connected with the medical departments of universities or of independent medical schools, the largest being that of the library of the College of Physicians and Surgeons, Philadelphia, with collections numbering 107,782 volumes. The Harvard Medical School has collections numbering 27,000 volumes, and Columbia with 28,960 volumes. Medical societies have also developed excellent libraries, among them being the Medical Society, County of Kings, Brooklyn, with collections numbering 70,000 volumes; New York Academy of Medicine, 101,593; Rhode Island Medical Society, 25,000; Boston Medical Library, 85,963.

Pedagogical Libraries.— Educational libraries form a comparatively recent phase in the development of special libraries. The largest and most comprehensive, that of the Bureau of Education, was founded in 1868 and numbers about 150,000 volumes. With the establishment of teachers' colleges many special pedagogic libraries have come into being, the most important of which are that of the Teachers' College (1887), affiliated with Columbia University (63,770 vols.); State Normal School of Indiana (Terre Haute, 1870; 70,926 vols.); State Normal School of Kansas (Emporia, 1865; 40,900 vols.); State Normal College of Michigan (Ypsilanti, 1852; 43,000 vols.); Southern Illinois State Normal University (Carbondale, 1869; 30,210 vols.); Chicago Normal College (1898; 25,000 vols.); Colorado State Teachers' College (44,800 vols.); School of Education, University of Chicago (35,000 vols.); Nebraska State Normal School (25,245 vols.); Peabody College for Teachers (Nashville, Tenn., 35,000 vols.); Hampton Institute (44,962 vols.); Glenville Normal School (W. Va.; 42,000 vols.); Wisconsin State Normal (Milwaukee; 27,510 vols.). There are approximately 208 normal school libraries in the United States.

Historical Libraries.— The majority of special historical libraries in America have been organized by historical societies, either regional, State or group. Many State libraries, in that they endeavor to collect local historical material, partake of the characteristics of special historical libraries. Among these may be noted the Alabama State Department of Archives (100,000 vols.); Colorado State Library (40,000 vols.); California State Library [*](207,134 vols.); New York State Library (449,542 vols.). Among the libraries whose collections cover the history of an area larger than a State may be mentioned the New England Historical Genealogical Society (39,711 vols.); American Antiquarian Society (Worcester, Mass.; 140,000 vols.). The State historical societies, however, have been most assiduous in collecting and preserving local historical material. Nearly every State has an active association of this nature and several possess very valuable collections, notably Kansas (1875; 90,689 vols.); Maine (1822; 40,000 vols.); Maryland (1844; 45,399 vols.); Massachusetts (1791; 56,000 vols.); Minnesota (125,000 vols.); Nebraska (53,000 vols.); New Jersey (30,000 vols.); New York (130,866 vols.); Pennsylvania (202,000 vols.); Rhode Island (90,000 vols.); Virginia (15,300 vols.); Wisconsin (376,000 vols.). A still more restricted phase is that of city historical societies, of which a number possess interesting collections, notably the Chicago Historical Society (24,738 vols.); Buffalo, N. Y. (40,000 vols.); New Haven Colony (8,000 vols.); New York Genealogical and Biographical Society (15,000 vols.); Essex Institute (Salem, Mass.; 115,856 vols.); Newport (R. I.) Historical Society (8,000 vols.); Western Reserve (Cleveland, Ohio, Historical Society; 44,850 vols.). A collection of great importance to students of early American literature and American history is the John Carter Brown Library at Providence (25,000 vols.). There are other collections representing special groups and interests that partake of the nature of historical societies, such as the Hispanic Society of New York (82,461 vols.); the Pan-American Union (Columbus Memorial Library, Washington; 37,965 vols.); Congregational Society (Boston; 64,561 vols.); the Presbyterian Historical Society (Philadelphia; 20,000 vols.); the Holland Society (New York; 6,500 vols.); National Society of the Daughters of the Revolution (Washington; 6,693 vols.).

Scientific and Technical Libraries.— The tremendous advances made in pure and applied science during the 19th century have resulted in the establishment of many scientific and technical libraries. The various activities of the national government has caused the location of a number of these collections at Washington. The special libraries in Washington in the most cases have been developed in connection with scientific bureaus and departments of the Federal government. In pure science may be noted the Library of the Bureau of Standards (14,900 vols.) and the library of the Smithsonian Institution with its magnificent collection of the publications of learned institutions and scientific societies[†] (521,616 vols.). The Coast and Geodetic Survey has a collection of 25,000 volumes on geodesy, surveying, hydrography, etc.; the Geological Survey, 220,000 books and pamphlets on geology, mineralogy and palæontology; and the Weather Bureau of 35,500 volumes and pamphlets on meteorology and climatology. The Bureau of American Ethnology has a collection of 33,430 items on ethnology, anthropology and American aborigines; the Bureau of Fisheries, 29,155 volumes on fisheries, fish culture, etc.; the Department of Agriculture, 137,700 volumes and pamphlets on agriculture, forestry, chemistry, botany, etc.; the Forest Service, 18,852 items on forestry. In military and naval sciences the Army War College has 100,000 items, Navy Department, 50,000, the United States Army Engineers' School, 45,115. Other collections on military and naval topics are at the United States Military Academy (West Point, N. Y.; 16,121 vols.); United States Naval Academy (Annapolis, Md.; 56,851 vols.); Coast Artillery School (Fortress Monroe, Va.; 28,034 vols.); Naval War College (Newport, R. I.; 21,000 vols. and pamphlets); Army Service Schools (Fort Leavenworth, Kan.; 32,000 vols. and pamphlets).

Libraries of Economics, Political Science and Sociology.— The literature of economic and social problems is to be found in the collections of the Interstate Commerce Commission, 23,000 volumes and pamphlets; Bureau of Foreign and Domestic Commerce, 20,000 volumes and pamphlets; Bureau of Labor Statistics, 32,000 volumes and pamphlets; Department of Commerce, 103,738 volumes and pamphlets; Treasury Department, 11,580 volumes and pamphlets. There is also in Washington a library of the United States public documents under direction of the superintendent of public documents which contains 193,533 volumes. Other special libraries in Washington, but non-official, are the Bureau of Railway Economics, 60,000 volumes and pamphlets, and the Volta Bureau (deafness), 9,000 volumes and pamphlets. The Library of Congress has a large collection of embossed books for the blind. Another interesting special collection at Washington is that of the Carnegie Endowment for International Peace, containing 11,000 items, peace, international conciliation and league of nations.

Science and Technology.— There are many scientific libraries, however, outside of the District of Columbia. The oldest collection of the sort is undoubtedly that of the American Philosophical Society, Philadelphia, founded in 1743. This has 65,413 volumes, mainly relating to pure and applied science. The American Academy of Sciences of Boston is probably the next in point of age, its date of foundation being 1780. It has 34,681 volumes. The largest library specializing in scientific and technical literature is the John Crerar Library of Chicago, with 384,603 volumes. Other collections of importance are Boston Society of Natural History, 40,617 volumes; Franklin Institute, Philadelphia (1824), 71,020 volumes, 28,845 pamphlets. The schools of technology have necessarily developed libraries along the lines of work treated in their courses. The largest is perhaps the library of the Massachusetts Institute of Technology numbering 121,711 volumes. The library of Cornell is also strong in technical works (489,654 vols.); Sheffield School (Yale; 12,500 vols.); Lehigh (130,000 vols.); Wagner Free Institute of Science (Philadelphia; 25,000 vols.); Rose Polytechnique Institute (Terre Haute; 15,360 vols.); Armour Institute of Technology (Chicago; 27,869 vols.); Stevens Institute (Hoboken;

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[*] Not including Sutro Library in San Francisco, 81,851 volumes.

Deposited in the Library of Congress.

1 California State Library, Sacramento, Cal.

2 Harper Memorial Library of the University of Chicago

12,700 vols.); Worcester Polytechnic Institute (15,000 vols.); Michigan College of Mines (28,050 vols.); Missouri School of Mines (20,495 vols.); Virginia Polytechnic Institute (26,072 vols.); Alabama Polytechnic (27,550 vols.). Many State universities pay attention to technology and the applied sciences, agriculture in particular. Among the noteworthy collections are those of the State agricultural colleges of Kansas (57,800 vols.); Michigan (38,561 vols.); North Dakota (26,620 vols.); and Utah (28,946 vols.). The University of Tennessee also has a valuable collection of agricultural books and pamphlets. The largest collection, however, is the spendid library of the Department of Agriculture at Washington, numbering 137,700 items.

Social Sciences, Economics, etc.—A very recent library development has been indicated in the departments of economics and sociology. The great industries have discovered the value of collections of literature, both as history and as a guide to future developments. Thus the railways of the United States have organized a Bureau of Railway Economics for the study of transportation problems. This has a library of some 50,000 items at Washington, D. C. Other libraries similar in purpose but in a different field are those that have been developed by the great insurance companies, the most noteworthy being that of the Prudential Insurance Company, at Newark, N. J., which has a collection which is said to number 200,000 items on life insurance and allied topics. The Mutual Life has 30,000 items; the Metropolitan 20,000 volumes; and the Insurance Library Association, Boston, 21,000 items. Finance is represented also by some interesting collections. Thus the National City Bank of New York has a library of 24,000 volumes on banking, etc.; American Bankers' Association, New York, 48,000 items; Lee, Higginson & Company, Boston, 50,000 items. See LIBRARIES, COMMERCIAL AND INDUSTRIAL.

A few special collections in sociology and social reform have appeared recently, the largest probably being that of the Russell Sage Foundation, New York, with 51,695 items. The Children's Bureau at Washington has a collection of books upon its specialty and the Bureau of Labor has a library of 32,000 volumes on economic and social topics. There are a great many society and association libraries in the United States, the collections of Masonic Order being of interest, that of the Supreme Council of the Scottish Rite at Washington containing some 75,000 items.

Bibliography.— Bostwick, 'The American Public Library' (New York 1910); Dana, 'A Library Primer' (Chicago 1910); Fletcher, 'Public Libraries in America' (Boston 1899); Jewett, 'Notices of Public Libraries in the United States' (Smithsonian Reports. *Appendix*. Washington 1857); United States Bureau of Education, 'Public Libraries in the United States' (Special report 1876; Washington 1876); id., 'List of Public Society and School Libraries'; 'American Library Annual.'

CANADA.

There are few records of collections of books in Canada prior to the establishment of the British colonies. Le Moyne d'Iberville is said to have gathered together all the works on the New World and carried them with him on his expeditions, but what became of them is unknown. The Jesuit Fathers, as is well known, were indefatigable chroniclers, but whether they were equally enthusiastic readers is less certain. At any rate the first library recorded in Canada was one organized by a group of British officers stationed at Quebec in 1779, who expended £500 in London in the purchase of books. This was first housed in the Bishop's Palace. In 1843 it was transferred to the Quebec Literary Association, and again in 1866 to the Literary and Historical Society, at which time it numbered about 7,000 volumes. The collection now numbers 16,000 volumes, mainly Canadian history.

Collections in Ottawa.— In Ottawa, the seat of the Dominion government, are centred the libraries developed by the various official departments. Of these the Parliament Library is the most important and, prior to the fire of 3 Feb. 1916, was the largest in Canada, numbering between 300,000 and 400,000 volumes. The departments of Justice (8,000 vols.), State Geological Survey (20,000 vols.) and the Supreme Court (38,000 vols.) are special collections that are growing rapidly.

Provincial Libraries.— The most important collection in Quebec is the library of the legislature of the province (1792; 107,218 vols.) and the University of Laval in the same place possesses about 102,000 volumes and contains much important historical material relative to Canada, and the B. Saint Sulpice (80,000), also in Montreal, has a most attractive building. Public libraries have developed to a very limited degree in Quebec, but the contrary is true of the province of Ontario. This has a widespread and thoroughly modern system modeled upon American and British methods. The value of the library is recognized and it is liberally supported. A considerable number are an evolution out of mechanics' libraries. These were taken over by the municipalities, the communities being taxed to maintain them under provisions of the Free Libraries Act, passed in 1882. Libraries were provided for in the law reorganizing the school system drawn up by Dr. Ryerson and passed in 1848, but only a few libraries were established at that time. There are more than 500 libraries, large and small, in Ontario. The largest and most active public library in Canada is the public library of Toronto with 15 branches and 300,000 volumes. The activity in Ontario has extended to the middle and western provinces, the Provincial Library of Manitoba at Winnipeg numbering 60,000 volumes; British Columbia having several active libraries, the Provincial Library at Victoria containing 30,000 volumes; while Alberta has three collections of over 10,000, the most important being the Public and Strathcona Library at Edmonton, containing 35,000 volumes. Many new and splendidly equipped buildings are being constructed in Canada, especially in the western provinces.

Traveling Libraries.— In 1890, a system of traveling libraries was initiated by Lady Aberdeen at a meeting of ladies in Winnipeg. This, called the Aberdeen Association, has endeavored to supply reading matter to settlers and isolated families in the Canadian Northwest. This association has distributed thousands of books, magazines, etc., and has brightened the lives of many lonely people.

University Libraries.— The largest and most modern university library in Canada is that of McGill University at Montreal. This has six branches and its collections number about 152,000 volumes. The University of Toronto has also an excellent library numbering some 148,434 volumes.

There is an active library association in Canada, which was established in 1900. Canadian libraries have suffered severe losses by fire during the recent years — the collections of the University of Toronto, of the Provincial Library of Quebec and finally the Parliament Library at Ottawa was partially destroyed in the burning of the Parliament buildings, 3 Feb. 1916.

LATIN AMERICA.

The continuous social and political unrest and the upheavals that have marked the course of affairs in the Latin American countries have had an injurious effect upon the development of libraries. Prior to the establishment of the various states, the only collections were in the religious institutions. These, however, in most cases were of minor importance, and during the 19th century were allowed to decline or were merged with the public collections. In a few of the more progressive states, such as Argentina and Mexico, provision was made for national libraries in the middle of the last century. As early as 1867 a national library was instituted in Mexico and in 1873 the librarian of the Argentine National Library, V. G. Quesada, made a trip to Europe in order to study its famous libraries, which resulted in an elaborate work entitled ‹Las Bibliotecas Europas y algunas de la América Latina› (Buenos Aires 1877).

Mexico.— In 1913 there were about 150 libraries in Mexico, of which the most important is Biblioteca Nacional. This was formed from the collections of the various religious and educational institutions that came into control of the state when the Liberal party came into power. It was opened to the public in 1884. Its collections number about 200,000 volumes.

Central America.— Several of the Central American states have libraries, the majority, however, being relatively unimportant, that of Costa Rica, at San José, being housed in a new building with a system of arrangement, cataloguing, etc.

Cuba.— One of the most active and up-to-date libraries of Latin America is the B. Nacional at Havana, Cuba, founded in 1901.

South America.— With the exception of Argentina, Brazil and Chile there are very few collections of great importance in South America. Colombia has a national library at Bogota, Bolivia has a number of small collections, as has Peru at Lima, while Paraguay established a Biblioteca Nacional in 1915.

Brazil.— The largest and perhaps the best equipped library in South America is the Bibliotheca Publica Nacional at Rio de Janeiro, Brazil. This was founded in 1810 and its collections of over 330,000 volumes and 500,000 manuscripts, etc., are housed in a splendid new building completed in 1910 at a cost of $1,500,000. The most modern methods are in use here and in other libraries in the country.

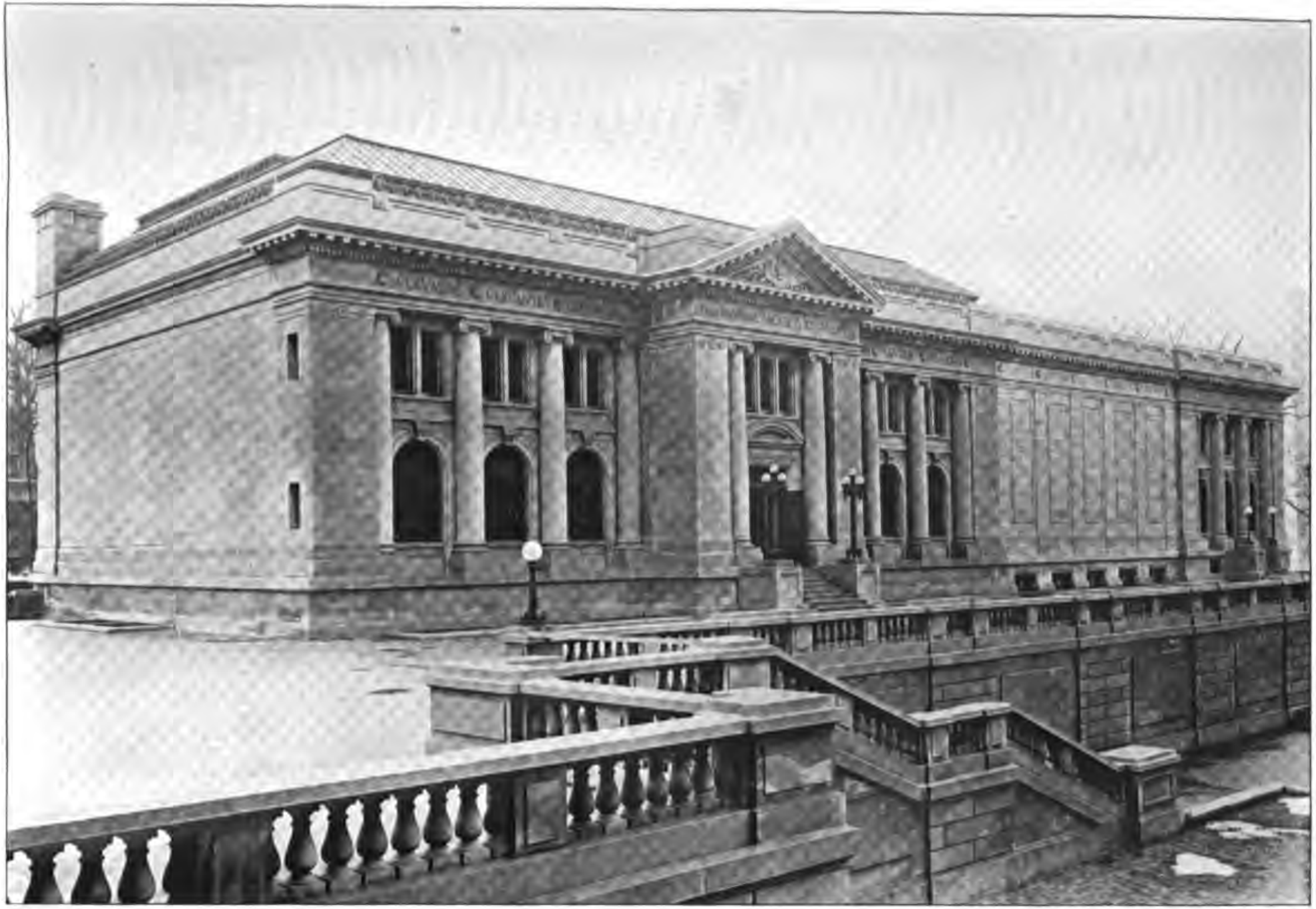
Argentina.— The interest in libraries is more active and widespread in Argentina than any other South American state. There are fully 200 libraries of all types, the most important, of course, being the Biblioteca Nacional at Buenos Aires. This was founded in 1810 by Dr. Mariano Moreno, the first collections being derived from the library of the bishop of Buenos Aires. The collections now number about 300,000 and contain some interesting manuscripts relative to the early Spanish period.

GREAT BRITAIN.

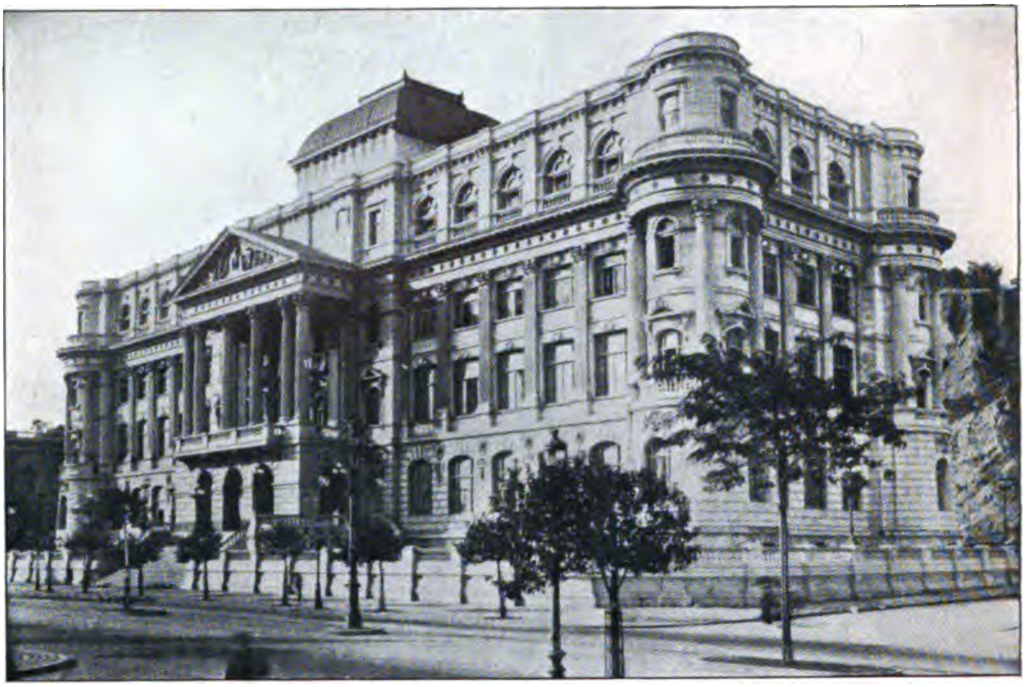
The English kings apparently were indifferent lovers of books. So far as is known, none but George III formed a library worthy of the name. In one case the power of the king reacted injuriously upon British libraries, for as a result of the conflict of Henry VIII with the Holy See the valuable monastic and other ecclesiastic collections of the pre-Reformation period were destroyed or scattered. Some of these books, however, were saved by John Leland (q.v.) and other book-lovers. For this reason but few of the existing British libraries assign a very early date to their foundation. In fact, according to published records, only 37 containing more than 50,000 volumes were founded prior to 1800. Of these, two, the Cambridge University Library (1444) and Lincoln's Inn Library (1497), were founded during the 15th century; six during the 16th century, eight during the 17th century, 11 during the 18th century and 64 during the 19th century.

Among these institutions, the British Museum (q.v.) of course assumes greatest importance. The date of its foundation is usually designated as 1753, the year of the bequest of Sir Hans Sloane, yet Edward Edwards finds the origins of its collections in a much earlier period. A royal library, according to Walpole, was established by Henry VIII, which was increased by gifts from monarchs abroad. Slight additions were made under Henry VIII, but during the brief reign of Edward VI was a decided development owing to the efforts of Sir John Cheke and Roger Ascham. The accessions later of the collections of Henry, Earl of Arundel, Lord Lumley, Archbishop Cranmer, Casaubon, Sir John Morris and the Orientalia of Sir Thomas Roe formed the nucleus, to which was added the splendid collections of Sir Hans Sloane and King George III.

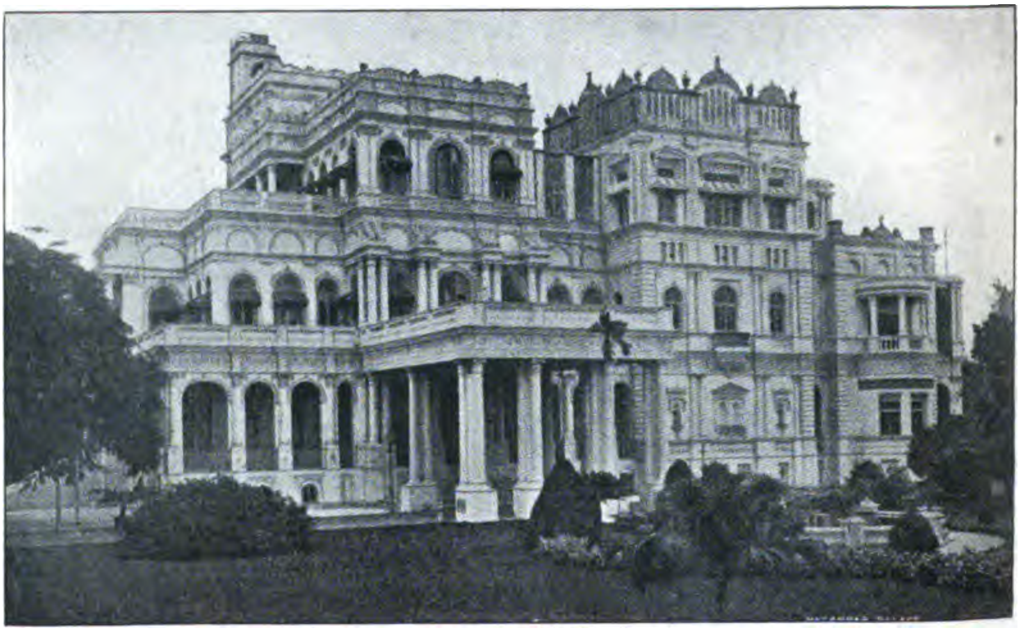
University Libraries.—As one would expect, the earliest large collections were formed by the universities, many of which have grown into imposing libraries. The oldest of these, and one of the most ancient in England, is the Cambridge University Library. That it was in existence prior to 1425 is indicated by a list of its books made at that time. Its first great benefactor was Thomas Scott, archbishop of York, who erected the building (1475) in which it was housed until 1755, and who made additions to its collections and endowment. It contains about 900,000 volumes, which include many early English imprints. More famous, even, than the Cambridge Library is that of Oxford, named the Bodleian, after the founder, Sir Thomas Bodley. It was due to the enthusiastic labors of this bibliophile that the Bodleian was opened to the public in 1602 with 2,000 volumes, almost entirely gifts from



LIBRARY AND MUSEUM OF THE HISPANIC SOCIETY OF AMERICA, NEW YORK CITY



Bibliotheca Nacional, Rio de Janeiro



Central Library Building of Baroda, India. Formerly a Palace of the Maharaja his private collection. These activities were crowned by the generous provisions contained in his will. Other distinguished benefactors were Archbishop Laud, Sir Kenelm Digby, John Selden, Francis Douce, etc. The library now contains about 800,000 volumes, 41,000 manuscripts, which include a wonderful collection of Orientalia, Greek and Latin manuscripts, and much valuable material in history and literature. In 1860 it was united with the Radcliffe Library of Medicine and Science, the collections being transferred to the Radcliffe Camera, its present home. Among the university libraries of Scotland, those of Edinburgh and Saint Andrews are the most important. The library of the latter is perhaps the older of the two, as the university is known to have possessed books as early as 1456, but the assigned date is 1610 at which time the various collections were united by command of King James VI. It contains about 150,000 volumes, including valuable local history. Edinburgh University was founded in 1583 by the bequest of the library of Clement Little, a lawyer of Edinburgh. This collection was transferred to the university at its foundation in 1583. Among the library's benefactors was the famous Scotch poet and bibliophile, Drummond of Hawthornden, who made a large donation of books in 1627. The collections number 270,000 volumes and 800 manuscripts. The library of Trinity College at Dublin had a somewhat romantic beginning, having been founded by a gift of £1,800 made by the English army as a memorial to its victory over the Spanish at Kinsale in 1602. This sum was placed in the hands of James Usher, later primate of Ireland, who was a friend of Bodley, the two co-operating in the interest of their libraries. Usher's own library was purchased at his death in 1655 but its transfer to the university was held up by Cromwell, and not consummated until the Restoration. The library has received many valuable gifts of books and manuscripts and now numbers about 350,000 volumes and 2,078 manuscripts. Among the more recent university foundations may be named the University College Library, London (1823; 150,000 vols.) and the University of London (1839; 100,000 vols.). The majority of the English cathedrals have collections of books. The most of these, however, are small and their use is usually restricted to the diocesan purposes. A few, however, are open to the public.

Public Libraries.— The development of the free public library has in the main followed a course parallel with that in the United States, the movement toward popularization of existing collections and the establishment of new ones occurring simultaneously in both countries. The work of the public library of to-day was formerly done by proprietary and subscription libraries, analogous to the mechanics' libraries in the United States. Some of these, such as the London Library, founded by Carlyle, Gladstone and other distinguished men, are still operative, but in great part they have been absorbed by the public libraries. The most active worker for the establishment of free public libraries was Edward Edwards, the author of 'Memoirs of Libraries.' At a meeting of the Statistical Society, 20 March 1848, he read a paper in which he deplored the lack of interest in free libraries. He found only 29 free libraries, possessing more than 10,000 volumes each, while France had 107, Austria 41 and Switzerland 13. This paper attracted the attention of William Ewart, M.P., and resulted in the appointment of a library commission on the subject of public libraries, and finally in the Public Libraries Act of 1850. (Consult Axon, 'Statistical Notes on the Free Town-Libraries of Great Britain,' *Journal of the Statistical Society,* September 1870). The development under the provisions of this act was slow. Prior to 1886, 133 libraries had been established; from 1887 to 1890, 70; since which date the annual average was 17. Under a new law, which came in force in 1893 "any local authority (i.e., town council or district board), save in the county of London, may establish and maintain public libraries without reference to the wishes of the rate payers." (*Library Journal,* Vol. XVIII, p. 422). Since 1900 the growth of free public libraries in Great Britain and her colonies has been remarkable. Not a little of this has been due to Andrew Carnegie, whose benefactions have been extended to the British Empire.

Only two of the great British public libraries, Dundee, Scotland (1601; 154,922 vols.), and Bristol (1613; 180,825 vols.), were established prior to the 19th century. Indeed, the tremendous growth in free public libraries has been a very recent thing in all countries. This is indicated in Great Britain by the fact that some of the most important free libraries in the kingdom have been established during the last few decades. Thus Glasgow (430,000 vols.) was founded in 1877; Lambeth-Tate, London (159,000 vols.), in 1886; Edinburgh Public Library (200,000 vols.), in 1887; Hull (106,000 vols.), in 1892; John Rylands in Manchester (200,000 vols.) is one of the relatively few private endowed libraries in England. This was founded by Mrs. E. A. Rylands in 1899 as a memorial to her husband and is housed in a splendid building. Its collections are based upon the famous Althorp Library, formed by Earl Spencer. Other public libraries of more than 100,000 volumes are Birmingham (1861; 445,675); Bolton (1852; 128,322); Bradford (1871; 178,035); Cardiff (1862; 221,000); Liverpool (1850; 338,796); Guildhall Library, London (1824; 148,757); Westminster, London (125,000); Manchester Free Public Libraries (1852; 500,000); Newcastle-upon-Tyne (1874; 170,000); Nottingham (1868; 149,657), and Sheffield (1853; 186,551).

Special Libraries.— There are many valuable special collections in Great Britain, among which may be noted: *Law:* London, Inner Temple (1540; 58,000); Lincoln's Inn (1497, 72,000); Edinburgh, Signet (1722; 122,000). *Political Science Statistics, etc.:* London, British Library of Political Science (1896; 300,000); Foreign Office (75,000 public documents); Reform Club (1836; 56,000); Royal Colonial Institute (1868; 100,000); Royal Statistical Society (1834; 50,000). *Medicine:* London, Royal College of Physicians and Surgeons (60,000). *Science:* London, Royal Society (1662; 80,000); Science Museum (105,000); British Museum, Natural History Library (1881; 72,000); Society of Antiquities (40,000); Geological Society (1807; 30,000); Linnean Society (1788; 35,000); Royal Geographical Society (1830; 50,000); Chemical Society

(1841; 25,000). *Military and Naval Science:* London, British Admiralty (1700; 50,000); Royal United Service Institution (1831; 32,000). *Fine Arts:* National Art Library (1841; 115,000). Consult Edwards, 'Memoirs of Libraries' (London 1859); Garnett, 'Essays in Librarianship' (London 1899); Ogle, 'The Free Library' (London 1897); Rye, 'The Libraries of London'; Savage, 'The Story of Libraries and Book-Collectors' (1909).

AUSTRIA-HUNGARY.

Owing to the fact that Austria has remained firm in her allegiance to the Roman Catholic Church, the library situation there is rendered interesting by the great number of monastic collections remaining intact. From the viewpoint of the bibliographer they are of immense interest, some of them having been founded in the early mediæval period and still in possession of their ancient treasures. There are 13 of these libraries containing over 50,000 volumes of which the following may be noted: the Benediktinabtei at Admont (1074; 88,000); Closternburg (1106; 81,000); Kremsmünster (777 and 1571; 91,000); Moelk, Salzburg (fd. circa 790 by Archbishop Arno, 72,000). In modern library movements, however, Austria, until recently, has not taken an active part. For a long period the empire possessed the richest collections in Europe, but they have not kept pace with those of Germany, Great Britain and France during the 19th century. In the K. K. Hofbibliothek at Vienna, Austria possesses, however, a library of the first importance. This is based upon the palace collections of Emperor Frederick III, established in 1440, but its growth was limited until the reign of Maximilian I, who is considered to have been the real founder by its noted librarian, Lambrecius. One of its early librarians was Enea Silvio Piccolomini, who later became Pope Pius II. The library is housed in an imposing and elaborately decorated building on Josephplatz and was completed in 1826. It has many exceedingly valuable and interesting collections, among them being the library of the famous Fugger family, manuscripts from the collections of Matthew Corvinus, king of Hungary, the library of Tycho Brahe, the astronomer, that of Prince Eugene of Savoy, etc. The collections number about 1,000,000 volumes, 8,000 incunabula and 27,000 manuscripts. Of particular importance is the collection of 100,000 papyri formed by the Archduke Ranier.

University Libraries.— With the exception of the Hofbibilothek at Vienna, the most important collections in Austria are those possessed by the universities, the largest being the K. K. Universitäts-B at Vienna. This was founded in 1775 by the Empress Marie Theresa, and contains 882,394 volumes, 663 incunabula and 906 manuscripts. Other large university collections are Budapest (1635; 491,831 vols.); Cracow (1400; 429,355 vols.); Czernowitz (1852; 222,133 vols.); Graz (1586; 271,000 vols.); Innsbruck (1746; 266,812 vols.); Klausenburgh (1872; 253,000 vols.); Lemberg (1784; 241,000 vols.); Prague (1784; 381,000 vols.).

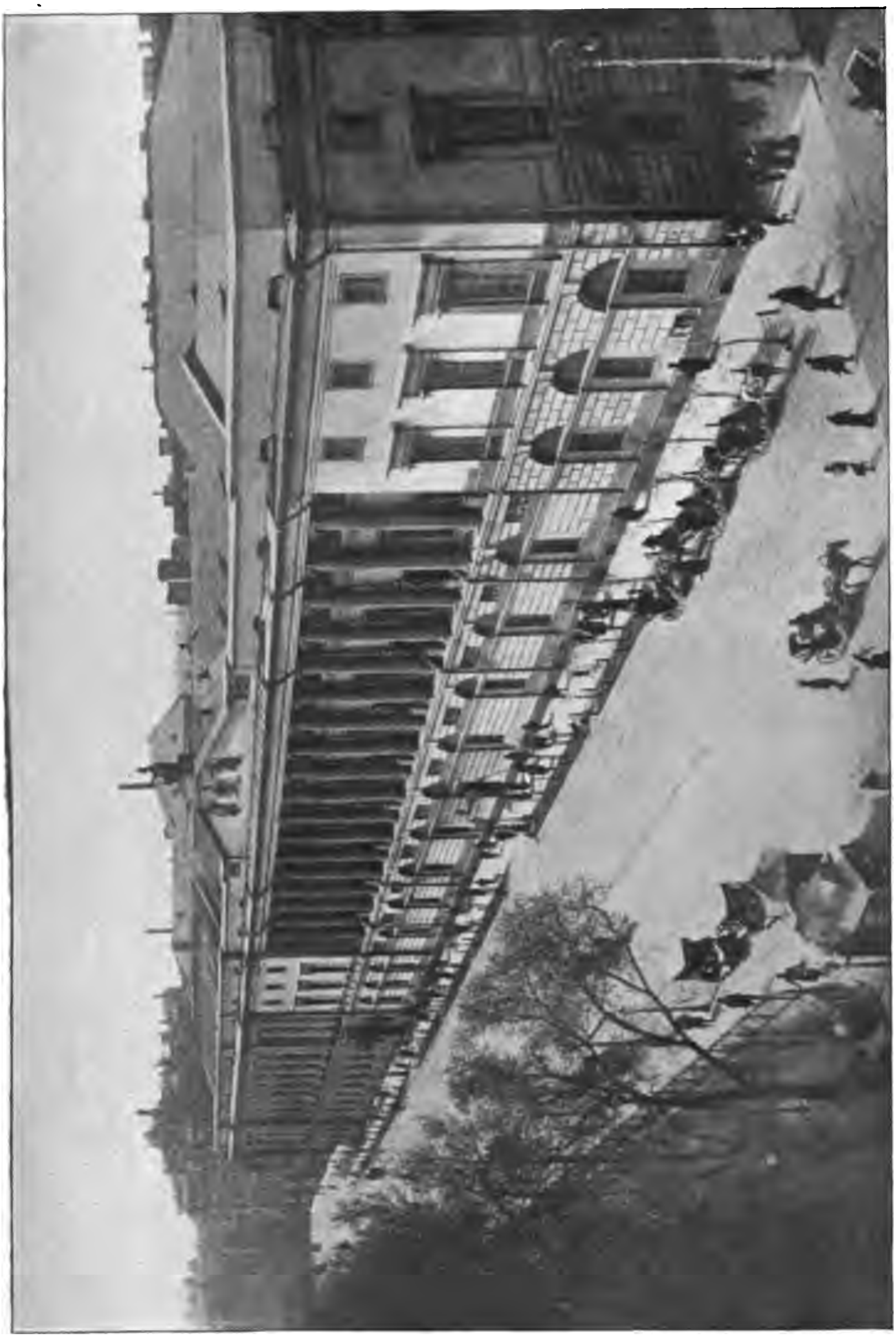
Special Libraries.— The following special collections may be noted: *Law, Politics, Statistics, etc.:* Fürstl. Leichsteinische Fidei-Kommiss-B. (100,000 vols.); K. K. Familien-Fideikommiss-B. (1784; 250,000 vols.); Archiv u. B. des K. K. Finanz-Ministeriums (63,000 vols.); B. des Ö. Reichsrats (1873; 56,000 vols.), in Vienna, and B. des K. Ungar Statistiches Amt. (1867; 118,132 vols.), in Buda-Pest; *Theology:* Reform-Theologische-u.-Rechts-Academie B., Sarospatak (1531; 60,000 vols.); *Science and Technology:* K. K. Geologische Reichsanstalt-B. (1849; 65,000 vols.); Hungarian Academy of Sciences (160,000 vols.); the Königl. Ungar. Josephs-Technis. Hochschule-B. (1850; 105,098 vols.), in Buda-Pest, and the K. K. Technis. Hochschule-B. (140,173 vols.), in Vienna. Consult Bohatta and Holzmann, 'Adressbuch der Bibliotheken der oesterreich-ungarischen Monarchie' (Vienna 1900); Kukula, 'Die oesterreichischen Studienbibliotheken in den Jahren 1848–1908' (Vienna 1908); Gulyas, 'Das ungarische Oberinspektorat der Museen u. Bibliotheken' (1909); 'Die über 10,000 Bände zählenden oeffentichen-Bibliotheken ungarns in Jahr 1908' (Buda-Pest 1910).

FRANCE.

The greater part of the French libraries originated in the collections of religious orders and the mediæval universities. These collections, many of which date back to the 14th and 15th centuries, remained relatively intact until the Revolution, during which the libraries suffered in common with all of the institutions of the nation. Yet its effect on library development in France, on the whole, was beneficial, for while many valuable manuscripts and books were lost, yet their loss was more than compensated by the foundation of the public library system of France, which was for many years superior to any. When the monasteries and other religious foundations were disestablished, their libraries were made the property of the state and placed in the care of the communes, thereby forming the nuclei of the present bibliothèques municipales, or free public libraries. This transfer was made under the Decrees of the Constituent Assembly, 1789 and 1790, and of the Legislative Assembly, 1792 and 1793. The Decree of 1793 fixed the distinction between libraries and archives and laid the foundation for the provincial libraries. The provisions of these enactments were strengthened by the Orders of Napoleon, 1803 and 1809, which provided for the organization and administration of these libraries.

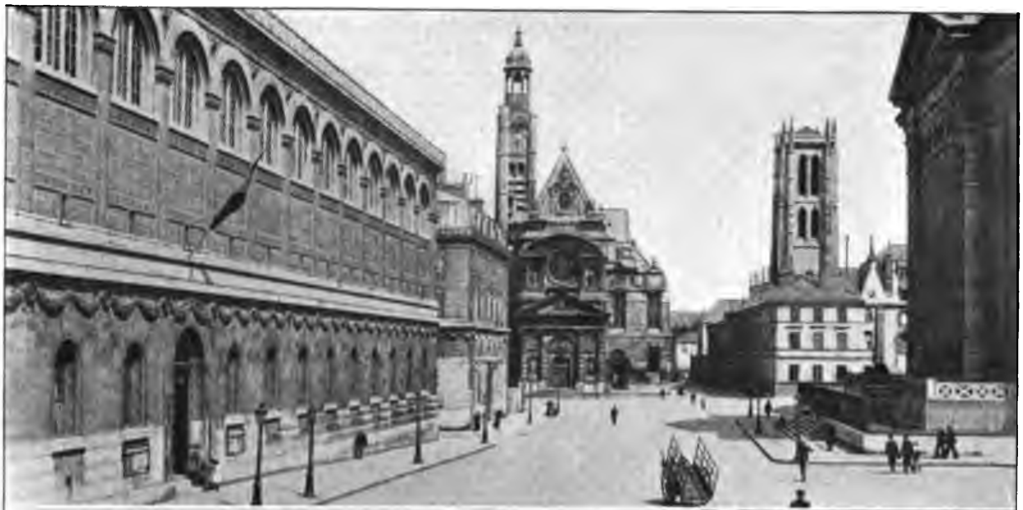
Municipal Libraries.— The majority of the municipal libraries, therefore, as now constituted, were established during the early portion of the 19th century, yet, as has been indicated, their original collections are vastly older. The earliest existent collection, if the German guns have spared any of it, is the Bibliothèque Municipale of Rheims founded in 1146, while that of Angers was established by Alain de la Rue in 1376. Michel Anglici began the collection now the library of Charpentras in 1452. This still retains many of the manuscript rarities of the original collection. The Bibliothèque Municipale of Bourges was established in 1466, and that of Clement-Ferrand by Mathieu de la Porte in 1490. Francis I founded the library of Lyons in 1527, which was originally a part of the Collège de la Trinité, established at the same time. The collection later passed into the hands of the Jesuits, and suffered considerable losses when the order was suppressed. Its collections have

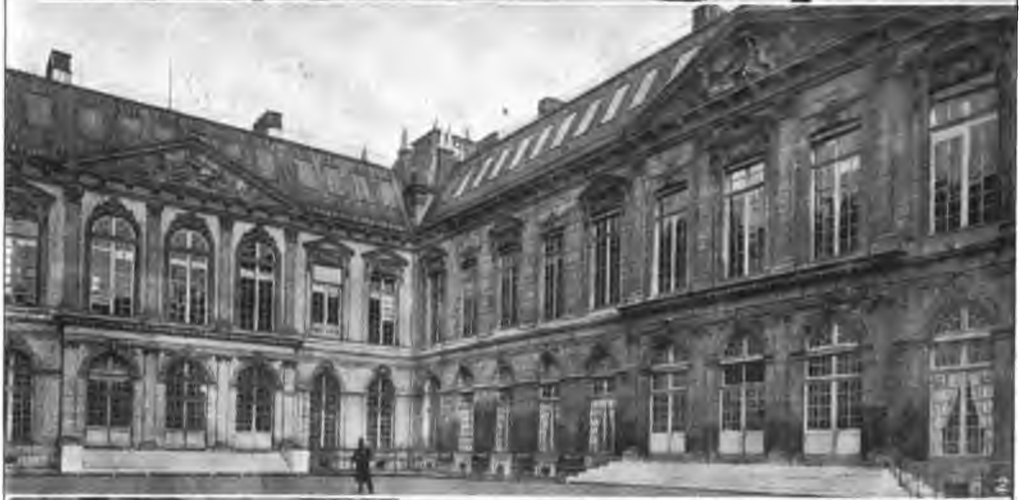
LIBRARIES

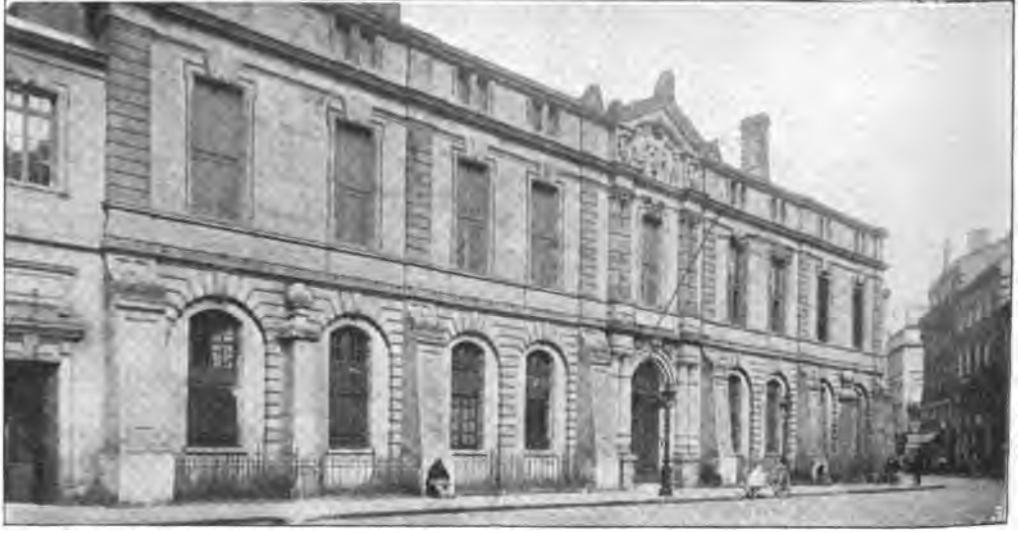


Public Library, Petrograd

LIBRARIES







1 Bibliothèque Sainte Geneviève, Paris
2 Bibliothèque Nationale, Cour d'honneur, Paris
3 Bibliothèque de la Ville, Bordeaux

been largely increased by private benefactions. A library, free to the public, was established at Aix-en-Provence in 1409. This was partially scattered, but restored in 1705 with the gift by André Tournon of his private collection and 7,000 francs for the establishment of a free public library. The Bibliothèque Municipale of Tours originated in the collections of the abbey of Marmoutiers and other religious foundations of the region. Its earlier collections have suffered losses, but is now one of the largest public libraries in France. Another ancient library of France is that of Caen, William the Conqueror's town, which was founded in 1431. In spite of the vicissitudes of many wars, particularly the religious ones, it has developed into its present collection of 128,000 volumes. It was suppressed in 1701, but reopened in 1736. Cardinal Fleury was one of its most liberal benefactors. The Bibliothèque Municipale of Lille is based like the others upon church collections and must have been established prior to the 14th century as a catalogue of that period is still in existence. It likewise suffered losses during the Revolution, but at the same time was augmented by additions from other monastic collections. Just what it has suffered from the German occupation is yet to be determined. One of the largest municipal libraries to develop from ecclesiastical origins is that of Rouen, which has steadily grown to its present size of 150,000 volumes. It was largely increased in 1855 by the accession of the splendid collection of M. Leber, containing 50,000 choice books and manuscripts. The Bibliothèque Municipale of Troyes was founded in 1651, by the gift of the library of Jacques Hennequin, to the Cordeliers of Troyes, on the condition that the library be opened to the public (135,550 vols.). When the religious orders were suppressed this collection, with that of the Oratorians and the remnants of the collection of the famous abbey of Clairvaux, were united to form the municipal library. Many of its treasures have been lost, but rare and precious items still remain, some antedating the death of Charlemagne. Among its collections of particular interest are the autograph works and correspondence of the Port Royal fraternity. The library of Besançon (103,830 vols.), founded by the Abbé Boisot in 1696, contains many manuscripts from the famous library of Cardinal Granvelle which had passed into the hands of the abbey of Saint Vincent and turned over to the city during the Revolution. Douai library (96,186 vols.), founded in 1767 under the auspices of the university, received in 1791 the splendid collection of the Benedictine Community of Marchiennes, which contained 1,718 rare manuscripts. The Bibliothèque Municipale of Bordeaux (200,000 vols.) owes its origin to the bequests of MM. Bel and Cardoze to the Bordeaux Académie des Sciences in 1738. This collection has been generously added to by the city. Among other French libraries of interest may be noted: Rochelle, originating in the collection of the Consistoire Réformé de la Rochelle, 1604 (109,712 vols.); Dijon (125,000 vols.), founded by P. Fevret in 1701; Nancy (142,018 vols.), founded by Stanislas in 1750; Nantes (220,000 vols.), 1753; Nice (60,000 vols.), founded by Abbé Massa in 1786; Nimes (110,000 vols.), founded by Jean de Dieu and R. Bion in 1778; Perpignan (35,000 vols.), founded by Maréchal de Mailly in 1759; Rennes (120,000 vols.), 1733; Toulouse (213,000 vols.), founded by the archbishop of Brienne in 1782; Marseilles (124,039 vols.), 1799.

Paris, of course, is richest in libraries of all types. The principal institution is the Bibliothèque Nationale, one of the world's greatest libraries, the importance of which calls for a detailed description. (See special article NATIONAL LIBRARY OF FRANCE). Next in importance to the Bibliothèque Nationale is the Bibliothèque Saint Geneviève, founded by Cardinal de Rochefoucauld in 1642. Originally it was the library of the abbey of Saint Geneviève, which he gathered upon his appointment as abbot. From this small beginning, it developed under the librarianships of Du Molinet, Gillet, Le Courayer, Mercier de Saint Léger, Pingré, Lemonnier and the historian Daunou. It steadily increased until at the outbreak of the Revolution it possessed about 80,000 printed books and 2,000 manuscripts. Two noteworthy collections were added during the 18th century; the splendid collection of Archbishop le Tellier (1716; 45,000 books and manuscripts) and that of the Duke of Orleans in 1791. At the dissolution of the abbey (1791), the library became state property and was renamed the Bibliothèque Panthéon. During the empire it was united with the Lycée Henri IV. The collections of the Bibliothèque Saint Geneviève number at present about 400,000 books, 1,225 incunabula and 3,855 manuscripts. The Bibliothèque Mazarine is of great interest in part owing to its founder, the great cardinal, and in part to the treasures it contains. The famous Gabriel Naudé, the first librarian, opened it to the public in 1642. It was dispersed by the Fronde but reconstituted in 1661, at which time it contained about 40,000 volumes. The collection remained in the Mazarine Palace until 1688 when it was transferred to the Collège de Mazarine. Its collections number about 250,000 volumes, 1,900 incunabula and 4,600 manuscripts. The Bibliothèque de l'Arsenal owes its origin to Antoine d'Argenson, Marquis de Paulmy, who in the midst of a life of greatest activity as a general, statesman and author contrived to gather a private library of approximately 100,000 volumes. At his death in 1789, this was acquired by the Comte d'Artois who united it with the equally splendid collection of the Duc de La Vallière. This collection, in 1858, contained 202,000 volumes and some 6,000 manuscripts. Its collections in 1915 numbered 624,904 volumes and 10,341 manuscripts. It possesses the most complete collection extant of romance literature, of drama, particularly of the period of mystery plays and by early French poetry.

Special Libraries.— There are, in all, about 200 libraries in Paris of which many are special collections of great importance. Of these the Bibliothèque des Archives may be mentioned. It was founded by the Daunou in 1808 and contains 30,000 volumes, mainly source material in history. A library similar in nature is that of the Office de Législation Etrangère et de Droit Internationale. Other special libraries are *Law:* Bibliothèque des Avocate (1704; 65,000 vols.); Bibliothèque de la Faculté de Droit (100,000 vols.); *Legislation:* Bibliothèque de la

Chambre des Députés (1706; 200,000 vols.); Bibliothèque du Sénat (1818; 140,000 vols.); *Medicine:* Académie de Médecine (1820; 60,000 vols.); Faculté de Médicine (220,000 vols.); *Military and Naval Sciences:* Bibliothèque du Ministère de la Guerre, founded by Louvois (135,000 vols.); Bibliothèque et Archives du Ministère de la Marine (1836; 100,000 vols.); Bibliothèque Hydrographique de la Marine (60,000 vols.); *Education:* Bibliothèque de l'Enseignement Public (80,000 vols.); *Science and Technology:* École Nationale des Ponts et Chausées (100,000 vols.); École Polytechnique (50,000 vols.); École Supérieure des Mines (1778; 5,000 vols.); Muséum d'Histoire Naturelle (220,000 vols.); Societé de Statistique (60,000 vols.); Bibliothèque de la Société de Géographie (60,000 vols.); *Music, Fine Arts:* Bibliothèque d'Art et Archéologie (100,000 vols.); Conservatoire National de Musique (1775; 80,000 vols., 500,000 music manuscripts); *Miscellaneous:* École Spéciale des Langues Orientales Vivantes (75,000 vols.); Bibliothèque Historique de la Ville de Paris (1872; 24,000 vols.); Institut de France (1795; 550,000 vols.); Bibliothèque Polonaise (1838; 100,000 vols.); Société de l'Histoire du Protestantisme (60,000 vols.).

University Libraries.— In comparison with the libraries of some of the provincial universities, that of the Université de Paris, or the Bibliothèque de la Sorbonne (600,000 vols.), is of relatively recent birth, having been founded in 1762. Next to the Bibliothèque Nationale it is the richest in special collections and source material. In 1897 it was housed in the buildings of the New Sorbonne, even then inadequate for its collections. Many of the provincial university libraries date from the mediæval foundations of their schools. Thus the Bibliothèque Universitaire, Aix-en-Provence (85,000 vols., 63,000 theses) was established in 1409, that of the University of Bordeaux (107,000 vols., 174,400 theses) in 1441. More recent foundations are the University of Grenoble (1879; 175,000 vols.); Lille (407,000 vols., 194,000 theses); Lyon (137,352 vols., 117,000 theses); Montpellier (126,399 vols., 127,000 theses); Nancy (107,254 vols., 106,000 theses); Poitiers (114,000 vols., 170,000 theses); Rennes (1733; 193,000 vols., 68,000 theses); Toulouse (1879; 140,000 vols.).

Prior to the 20th century France was perhaps better supplied with excellent collections of books than other countries. Her institutions have tended to cling to old methods, hence the modern movement that has transformed bibliographic systems in the United States and England has been but slowly accepted there. In 1906, however, the Minister of Public Instruction appointed a committee to study the condition of the archives and libraries of France which presented a report recommending radical reforms in methods, and a more liberal treatment of libraries and their personnel in income and scholarly recognition. At this time, also, a national library association was founded and a periodical started which might serve as an organ of intercommunication between librarians. There is every reason for believing that this movement will prove as wholesome for library conditions in France as the similar ones in Great Britain and America. Consult Marcel, H., and others, 'Bibliothèque Nationale' (2 vols., Paris 1907): Franklin, 'Guides des savants, des littérateurs, etc., de Paris' (Paris 1908); Le Prince, 'Essai historique sur la Bibliothèque du Roi, aujourd'hui Bibliothèque Impèriale' (Paris 1856); Martin, 'Histoire de la Bibliothèque de l'Arsénal' (Paris 1899); Morel, 'Le Développement des Bibliothèques publiques' (Paris 1899); Mortreuil, 'La Bibliothèque Nationale' (Paris 1878); Pécheur, 'Histoire des bibliothèques publiques du Départment de l'Aisne' (Soissons 1884); Saint-Albin, 'Les bibliothèques municipales de la Ville de Paris' (Paris 1896); Supercaze, 'Les bibliothèques populaires, scholaires et pédagogiques' (Paris 1892).

GERMAN EMPIRE.

The German Empire has a great number of large libraries. This is due in the main to the existence of the many separate states that form the empire, the rulers of which have encouraged the formation of libraries in their capital cities. The interest, likewise, taken by the Germans in popular education and in scholarship has had its effect also. Hence, while Germany has no individual collections that compare with the Bibliothèque Nationale or the British Museum, it has a dozen that exceed 500,000 volumes in size. Four classes of libraries may be distinguished in Germany, the Hof or Royal, the Stadt or Municipal, the university and the popular libraries, or Volk-bibliotheken.

In origin the German libraries, like the French, may be traced to three movements: (1) The mediæval or ecclesiastic foundations; (2) the humanistic or university; (3) the modern. As in France, it has been the privilege of the last period to gather together and organize the material that has been saved from the earlier collections. For this reason many of the German libraries assign their foundations as early as the 14th and 15 centuries. The suppression of the religious orders during and after the Reformation resulted in the liberation of many collections of books, some of great interest, and, while many valuable items were lost, a large proportion was saved as is evidenced by the splendid collections of manuscripts and early printed books in the various libraries.

Germany has produced many librarians and bibliographers of distinction, among whom may be noted Lipsius, Pertz, Panzer, Halm, Petzholdt, Heyne, Ritschl, Hain, Jahn, Forstmann and Dziatzko. The modern library movement, owing to the early efficiency and completeness of Germany's early library system, did not develop in that country until the beginning of the present century. While an excellent library journal, *Zentralblatt fur Biblioteksweşen,* has been in existence since 1884, no national association of librarians was formed prior to 1889. During the last decade legislation has been enacted in Prussia and Bavaria providing for more careful attention to the development of libraries and for raising the standard of librarianship, it being enacted in 1904 that librarians should be university graduates and candidates for the doctorate, and in 1907 a director of library affairs, under the Minister of Education, was established.

The Königl. Bibliothek at Berlin (1661) is not only the greatest library in Prussia, but, in a sense, fills the rôle of the national library of the German Empire. It is one of the 10 greatest libraries in the world, containing now about 1,500,000 volumes, 5,000 incunabula and 42,000 manuscripts. Its founder was the Elector of Brandenburg, Friedrich Wilhelm, who formed a collection in his palace in 1650, consisting mainly of spoils from monasteries destroyed during the religious wars. In 1699 the copy privilege was assigned, but no large additions were made either during the reigns of Friedrich Wilhelm I and Frederick the Great. The predilection of the latter for French literature, however, indirectly benefited the Royal Library, for he immediately turned over to it every book in the German language that came into his possession. Under Friedrich Wilhelm III many large additions were made. The library possesses important special collections, among which may be noted German history and literature, philology, the sciences and a splendid collection of incunabula. Its collections were housed for more than a century in an imposing but sombre building erected by the command of Frederick the Great during the years 1775–80. A new and more commodious building was erected in 1909.

The Königl. Hof-u. Staatsbibliothek, the Royal Library of Bavaria at Munich, has long been recognized as a model institution. It was founded during the reign of Gross-Herzog Albrecht V during the years 1550–79, its nucleus being the private library of the ruler. A building was erected for it in 1575 and the collections have gradually increased until it possessed about 20,000 volumes at the beginning of the 16th century. It suffered losses during the Thirty Years' War, but gained in the end, for a number of valuable collections, such as that of Gross-Herzog Christopher of Württemberg and the library of Tübingen, came to it as spoils of battle. All previous accessions, however, were overshadowed by the expansion under Maximilian Joseph resulting from the suppression of religious institutions, 150 of which were closed in 1803. Vast collections came from the Jesuits' College at Ebersberg, the Benedictine abbey of Saint Emmeran, Ratisbon and other monasteries of the same order; the canonries of Saint Udalrich, Saint Afra, and from libraries at Mannheim and Bamberg. Ludwig I was equally generous and during his reign many important special collections were received, such as those of von Moll and K. F. Neumann. He built the splendid palace on Ludwigstrasse, which houses the collections, the library being reorganized and reclassified when installed. The collections number about 1,200,000 volumes, 50,000 manuscripts and are particularly rich in Hebrew literature and Orientalia.

The Royal Library of Saxony, at Dresden, was founded by Elector Augustus in 1556, who established a collection in his palace, Castle Annaburg. In 1595 it contained 5,668 volumes. Its greatest expansion was experienced under Friedrich Augustus II, the second founder of the library. He installed it in a new home, adding a number of valuable collections such as those of von Besser and Maurice of Saxe. Under Friedrich Augustus III it took first rank, due mainly to the efforts of Prince Xavier, guardian of the young prince. Two vast collections were added; the Bünau (43,000 vols.) and the Brühl (62,000 vols.). In 1800 the collections numbered 200,000 volumes, in 1850 300,000 volumes, and at present it contains about 600,000 volumes and 6,000 manuscripts. It is particularly rich in German history, literature and the fine arts.

Among the other royal libraries may be mentioned Königl. Landesbibliothek of Stuttgart (603,186 vols.), opened to the public in 1777, containing at that time 6,000 volumes and 4,000 manuscripts from the palace collections at Ludwigsburg. It contains many of the books from the private library of the famous French scholar De Thou which were purchased when his library was dispersed. It is also famous for its collection of editions of the Bible. The Hertzogl. B. of Wolftenbüttel (300,000 vols.), founded by Julius, Duke of Braunsweig-Luneburg, in 1558, was a large collection at the beginning of the 18th century. The poet Lessing at one time was librarian and among its patrons was the philosopher Leibnitz, many of whose papers, however, are in the Königl. u. Provinzial-Bibliothek at Hanover (211,200 vols.), founded by Duke Johann Friedrich in 1660; Gotha, Öffentliche B. des Herzogl. Hauses, founded 1646 by Ernest I of Saxony, has been developed by the reigning sovereigns (25,000 vols. in 1723; 150,000 in 1858; 205,638 in 1912 and 7,655 manuscripts). The Grossherzogl. Hof-B. at Darmstadt (564,512 vols.) was founded in 1670 by Ludwig I, but based upon the collections of the Landgrave Ludwig VI. It contains manuscripts from Cologne Cathedral. Saxe Weimar has long been a centre of art and literature, its rulers encouraging all things that would foster learning. Hence the Grossherzoglich Bibliothek (300,000 vols.) is large and most interesting. It was founded in 1700 by Duke Wilhelm Ernest, who gathered all of the books of his predecessors together into one collection. During the 18th century it was accounted the best library in Germany. It contains a fine collection of military literature.

Municipal Libraries.— One of the most interesting and perhaps oldest of the German stadt or town libraries is that of Nürnberg, founded in 1445 by Dr. Konrad Kühnhofer, who presented his private collection to the city. To this has been added many valuable collections, notably that of Jerome Paumgärtner, the friend of Luther. It also contains monastic books, the manuscripts of Hans Sachs and of Dürer, and many rarities greatly treasured by the city. The collections, numbering about 112,000 volumes and 2,550 manuscripts, are housed in the ancient monastic building of the Dominicans. The Staats-Kreis.-u.-Stadtbibliothek of Augsburg was founded in 1537, its collections originally having been monastic. In 1806, when the city of Augsburg was ceded to Bavaria, the greater part of its library was transferred to Munich. Steps were soon taken to rebuild it and books were gathered from the convents and monasteries to that end. These amounted to 42,791 volumes, which were formed into a Kreisbibliothek. The collections number (1912) 205,000 volumes, 2,300 manuscripts. Hamburg contains a number of excellent libraries, of which the most important is the Stadtbibliothek, founded in 1529. This contains about 418,000 volumes, 917 incunabula, 8,000 manuscripts. Frankfort-on-Main also is well supplied with libraries, possessing four of more than 50,000 volumes each. The Stadtbibliothek, founded in 1668, is the largest, containing approximately 370,000 volumes. The Königl. Öffentliche B. of Bamberg (1611) contains splendid collections, being particularly rich in examples of early printing, the majority coming from the libraries of suppressed religious institutions. It is housed in the building of the former Jesuits' college. Among the other public libraries in Germany, too numerous to be discussed, may be noted those of Berlin (124,866 vols.); Lübeck (1620; 129,056 vols.); Mainz (1803; 235,000 vols.); Bremen (1660; 148,837 vols.); Breslau (185,000 vols.); Cassel (1580; 250,000 vols.); Cologne (1602; 255,000 vols.); Danzig (1591; 167,000 vols.); Treves (1803; 100,000 vols.); Weisbaden (1813; 172,211 vols.). Leipzig, the centre of German publishing activities, is also the home of a number of excellent libraries, among which may be noted the Bibliothek des Reichsgerichts (1870; 170,000 vols.), the Pädegogische Zentralbibliothek (1872; 190,000 vols.) and the Universitäts-B. (1543; 610,000 vols.). The Stadtbibliothek originated in a bequest of Hulderich Gross in 1677. It contains many valuable collections, among them that of Prof. H. L. Pölitz, the historian, bequeathed in 1838.

University Libraries.— The universities have played an extraordinary rôle in the development of modern Germany. This has been due in part to their large and well-equipped libraries and to the German research methods which enforce constant reference to their collections. The oldest German university library is probably that of Heidelberg, founded in 1386. Its modern development, however, dates from the purchase of the private library of the scholar Græevius by the Elector Palatine Johann Wilhelm, in 1707, who incorporated with it the remnant of the ancient library. Other collections were received from dissolved monasteries and other sources, and by careful purchases, until it comprehends at present 500,000 volumes, 200,000 theses and 3,530 manuscripts.

The University of Halle (Friedrichs-Universität Halle-Wittenberg) possesses an exceptionally well-organized library, rich in early printed books and research literature. Its foundation was laid in the purchase of the library of Prof. J. G. Simon in 1696, by duplicates from Berlin and the collections of Bergen Convent. The merging of the University of Wittenberg with Halle in 1816 resulted in another large increase. The collections now number about 300,000 volumes and 2,016 manuscripts. Another admirably equipped library is that of the University of Göttingen, founded by George II in 1734. The famous bibliographer Heyne was librarian for 50 years, and to this fact is due the completeness of its collections and their excellent catalogues. Heyne's successors were equally devoted. The library contains many valuable special collections, among them those of the historian Heeren, of von Bülow, Uffenbach and J. C. Jahn. The library is particularly rich in philology, history and science, and contains about 619,102 volumes and 6,940 manuscripts. The united Royal and University Library of Königsberg was founded by the Margrave Albert of Brandenburg, 1st Duke of Prussia, in 1534. The library at first was called the Schlossbibliothek. It numbers some 318,000 volumes and 1,500 manuscripts.

The Jena University Library (270,000 vols.) was founded by the transfer of books from Wittenberg in 1548. The Grand Duke Karl Augustus of Saxe-Weimar was a patron of it and Goethe took great interest in its development. Another splendidly equipped university library is that of Leipzig, containing some 610,000 volumes and 6,500 manuscripts. It was formed out of monastic collections in 1543 and is particularly rich in history, the sciences and classics. Among other university libraries of Germany may be noted Erlangen (254,083 vols.), formed by the Margrave Friedrich, in 1743, out of the collections of the margraves of Anspach and dissolved monasteries; Breslau (402,767 vols.), founded in 1811 from earlier collections and from the library of the former University of Frankfort-on-Main; Bonn (376,800 vols.), founded 1818 by the purchase of the collections of Prof. C. G. Harless and those of the former University of Duisburg; Marburg (265,000 vols.), founded in 1527 by Philip, Landgrave of Hesse; Rostock (294,000 vols.), founded by Grossherzog Albrecht of Mecklenburg in 1552, based in part upon the collections of the short-lived University of Bützow; Würzburg (400,000 vols.), founded by the Prince-Bishop Julius Echter v. Mespelbrunn; Giessen (261,747 vols.), formed of a collection purchased in Prague in 1605, and Tübingen (555,283 vols.), founded in 1477, based originally in monastic collections.

Special Libraries.— Germany has many excellent special libraries, of which the most important are at Berlin, the collections in law, medicine and technology being particularly noteworthy. As might be expected, the military collections are impressive, the Bibliothek des grossen Generalstabes, Berlin, numbering about 100,000 volumes, and that of Kreigsakademie about 105,000 volumes. The majority of the schools of technology have large and well-selected libraries. Consult ‘Addressbuch der deutschen Bibliotheken’; Ebert, ‘Geschichte u. beschreibung der K. Oeffentlichen Bibliothek zu Dresden’ (Leipzig 1822); Hortzschansky, ‘Die K. Bibliothek zu Berlin’ (Berlin 1908); Jaeschke, ‘Volks-bibliotheken’; ‘Jahrbuch der deutschen Bibliotheken’ (Leipzig 1902); Petzholdt, ‘Addressbuch der bibliotheken Deutschlands mit einschluss von Oesterreich — Ungarn u. der Schweiz’ (3 vols., Dresden 1875).

Italy.

The library history of the kingdom of Italy has its roots in antiquity. Here was established the first Western monastery, Monte Cassino, whose library still exists. This was founded by Saint Benedict in 529. It was in Italy that Petrarch, Boccaccio, Poggio and their confrères began the search for manuscripts and objects of ancient art that initiated the Renaissance. As in Germany, another thing that encouraged the development of libraries was development of the small states and free cities. The rulers of these, during the later mediæval period and throughout the Renaissance, were often patrons of art and learning who loved books and found much delight in collecting them. Many of the modern Italian libraries originated in such collections, and in spite of numberless wars and vicissitudes of all kinds they still possess a great share of their original treasures. Italy was deprived of many rarities during the wars with the first French republic and Napoleon, but the majority were returned after the fall of the latter. The unification of Italy and the establishment of the present kingdom resulted in the nationalization of the libraries, most of which passed under government control. Successive laws have been enacted for the organization and administration of these *biblioteca governati* which are under direction of the Minister of Public Instruction, who has under him a Board of Library Control. Careful watch is made over the library treasures. In 1875, 1,700 monastic libraries were confiscated by the state. These were transferred to the governmental libraries already in existence or new collections were formed (371 in 1875, 415 in 1878). The personnel of the libraries are government employees and are divided into the following classes: (1) librarians; (2) keepers of manuscripts; (3) assistants, cataloguers, etc.; (4) ushers, messengers, etc.

The national library of Italy is the Nazionale Centrale Vittorio Emanuele, in Rome, founded 1875, and based on the collections of the Collegio Romano, or Jesuits' College. It has the copy privilege and contains many splendid collections, such as the Farfensi, the Sessoviani manuscripts of Santa Croce, Jerusalem, and much material on the history of Italy, particularly the period of the Renaissance. Another important library in Rome is the Biblioteca Casanatense, founded by Cardinal Casanate in 1698. This contains 200,000 volumes, 2,000 incunabula, 5,000 manuscripts, many of them of the 8th to 10th centuries, and is rich in the literature of theology, law, economic, political and social sciences and history, particularly that of the Middle Ages. Among the other libraries of Rome may be mentioned the Biblioteca Universitaria Alessandrina called the Sapienza, founded by Alexander VII, in 1667, the Cossini and the Chiagi. The collections at Milan are perhaps next in importance to those of Rome, the largest being the Biblioteca Nazionale, or Braidense, founded in 1770 by Maria Theresa, who purchased the collections of the naturalist Haller consisting of 14,000 volumes and manuscripts. The collections have been greatly increased by transfers from religious institutions and by public and private munificence. It contains many interesting items, among the manuscripts of Dante, Galileo, Tasso and Manzoni. The collections number 259,680 volumes, 167,948 pamphlets, 1,834 manuscripts. There is an excellent catalogue in three parts, accession, author and subject, developed by Sacchi and Rossi. The classification system devised by Rossi for the Braidense has been adopted by other Italian libraries. More famous, even, than the Braidense is the Biblioteca Ambrosiana founded in 1609 by Cardinal Federico Borromeo, and based on his private collections. This is housed in an ancient conventual building adapted to the purposes of a library, and contains many bibliographic treasures, among them manuscripts of Petrarch and Laura, drawings and manuscripts of Leonardo da Vinci and rare examples of early books. In 1879 it received the library of Prof. C. Mensinger, «Biblioteca Europea,» containing material on the history and linguistics of Europe. Cardinal Mai, the celebrated antiquarian, was librarian of the Ambrosiana for several years.

Florence has a number of interesting collections, the oldest and most important being the Mediceo-Laurenziana housed in the Uffizzi Palace. It was formed from the collections, that of Lorenzo the Magnificent and the one gathered by Niccolo Niccoli and Cosimo. Edward Edwards, ‹Memoirs of Libraries,› Vol. 2, p. 369, calls this «The noblest monument which the Medicis have left of the glory of their line.» It has suffered many losses, particularly during the régime of Savonarola, yet it still remains one of the most interesting collections of bibliographic treasures in the world. Second only to the Vittori Emanuele at Rome is the Biblioteca Nazionale Centrale of Florence. This has developed from the amalgamation of the private collections of the famous bibliographer Magliabechi and the Biblioteca Palatina, formerly the library of the grand dukes of Tuscany and housed in the Pitti Palace. Magliabechi was librarian of the ducal library for many years during which time he gathered his own splendid collection, bequeathing it to the Grand Duke in 1714. Many valuable additions have been made to these collections, among them Poggi and Reviczky libraries. The library is very rich in Italian history and literature. Manuscripts of Machiavelli and of Galileo, Torricelli, Viviana and other early Italian scientists are among the collections. A new building, appropriated for in 1902, has been erected on the Corso dei Tintori, near Santa Croce. Its collections now number about 600,000 volumes, 900,000 pamphlets and manuscripts including many prior to the 11th century. Others of special interest are those of Boccaccio and Cellini. Among other Florentine libraries are the Biblioteca Riccardiana, rich in Italian literature, and the Biblioteca Marucelliana, remarkable for its collection of Italian art. The Biblioteca Marciana (library of Saint Mark's) is the most important one in Venice, and if the tradition that Petrarch founded it in 1362 is correct it is the oldest. At any rate books from Petrarch's collections were discovered by Tomasini. The present collection is based upon the gift of manuscripts and codices brought by Cardinal Bessarione from Constantinople and presented to Saint Mark in 1468. Many additions have been made from the collections of religious institutions and by private gift. The library is particularly rich in Venetian history and early geography and travel. It was first housed in the Libreria del Sansovino, from which it was transferred in 1812 to the Palazzo Ducale and in 1904 to the Palazzo della Zecca, or The Mint. Naples has a number of libraries, the most important being the Biblioteca Nazionale, opened in 1804. It originated in the library of Cardinal Seripando, to which large additions have been made, particularly in 1848 from monastic collections. It contains 395,439 volumes, 221,859 pamphlets, 4,218 incunabula, 7,997 manuscripts, and is very rich in scientific literature, particularly the publications of learned societies. The Biblioteca Brancacciano (115,000 vols.) was founded by Cardinal Brancaccio in 1690. Balogne, long famous as a centre of learning, has an excellent library, the Biblioteca Comunale, founded 1801 (313,133 vols.), which is especially rich in Orientalia, as has

Padua (Museo Civico, founded 1778, 230,000 vols.) and Modena, whose library, the Biblioteca Estense, is based upon the collections of the famous Este family, which were transferred from Ferrara to Modena by Cesare d'Este in 1598. It now forms the Biblioteca Estense-Universitaria. Other large collections are at Genoa, Pavia, Lucca, Palermo, Perugia, Pisa, Verona and Vicenza. The library at Messina was destroyed by the earthquake of 1908, but reconstituted in 1910.

University Libraries.— The universities of Italy are very ancient and the majority possess excellent collections of books. One of the oldest of these, Bologna, doubtless had some type of a library at an early date, yet the founding of its present collection is assigned to 1605 at which time the naturalist Aldrovandi bequeathed his collection of 3,800 volumes and 350 manuscripts to the university. Great additions were made by gifts from Count Luigi Marsili (1712), Mezzofanti, the famous bibliophile and linguist, and others. The collections now number 255,000 volumes, 880 incunabula, 5,000 manuscripts. The University of Padua, another early foundation, has a library of 300,000 volumes and Pisa one of 203,000 volumes. The Biblioteca Universitaria of Naples is based on a collection established by Joachim Murat in 1812. This was transferred to the unversity and opened to the public in 1849. It contains a number of monastic collections and is rich in medical and scientific works. Other important collections are at the universities of Pisa, Pavia, Genoa and Turin.

Special Libraries.— There are a number of important special libraries in Italy, the majority being in Rome. Among these are *Law, etc.:* The Biblioteca dei Deputati (133,700 vols.), Biblioteca del Senato (100,000 vols.); *Military Science:* Biblioteca Militare Centrale (70,000 vols.); *Music:* Biblioteca Musicale (115,000 vols.); *Agriculture:* Institute International d'Agriculture (60,000 vols.). Consult 'Le biblioteche governative del regno d'Italia' (Rome 1893); 'Le biblioteche popolari in Italia, relazione al Ministro della Pubblico Instruzione' (Rome 1893); Fabietti, 'Manuale per le biblioteche popolari' (Milano); 'Statistica della biblioteche' (Rome 1893–96).

NETHERLANDS.

The Netherlands has long been a centre of culture and there were many excellent public and private collections during the era of their greatest prosperity. Popular libraries have been in existence for centuries, but Belgium and Holland fell behind the states of Europe during the 19th century. Since 1900, however, considerable progress has been made. Modern methods have been applied, old libraries have been rejuvenated and many new ones established.

Belgium.— It is quite impossible to give any true statement of the libraries of Belgium at the present, on account of the destructive invasion of the Germans in the World War. We know that the wonderful collection of manuscripts and book rarities of the University of Louvain has perished, as doubtless is true of the collections at Liège, Tournai, Alost, Courtrai, Namur, Malines (Mechlin) and Mons.

Brussels of course has the largest and richest collections in Belgium, the Bibliothèque Royale containing about 700,000 volumes. Its present collections date from 1837, but it is based upon the ancient Bibliothèques des ducs de Bourgogne, and the Austrian rulers of the Low Countries. These were augmented by collections from suppressed religious institutions, particularly the Jesuits, but many valuable works were confiscated by the French during their occupation. Much of its modern development has been due to the activity of Van Hulthem, under whose direction it became one of the best libraries in Europe. It is particularly rich in Netherlands history. Brussels is also the headquarters of the Institut International de Bibliographie designed to constitute a centre for co-operative bibliographic work throughout the world.

Special Libraries.— The majority of the governmental departments have collections relating to their special fields, notably the library of the Ministry of War (120,000 vols.), Chambre des Représentants (100,000 vols.), Commission Centrale de Statistique (70,000 vols.), Ministère des Affaires Etrangères (100,000 vols.), Ministère de la Justice (50,000 vols), and Ministère des Sciences et des Artes (75,000 vols.). Other important collections are the Bibliothèque des Bollandistes (1640; 200,000 vols.), Bibliothèque de l'Académie Royale (141,000 vols.), the Bibliothèque Collective International (75,000 vols., proceedings of learned societies), Académie Royal de Médécine (100,000 vols.), Conservatoire Royal de Musique (60,000 vols.) and the Musée Plantin Moretus (1640), containing 26,000 books and manuscripts on the history of printing.

The Bibliothèque Communal et Universitaire at Ghent is based upon the collections of the Conseil de Flandres, College des Echevins, the Baudeloo Abbey and other suppressed religious institutions. It was made a public library in 1797 and merged with the university upon its foundation in 1817. Collections, 450,000 volumes. The only library of importance in Antwerp is the Bibliothèque Municipale, founded according to some authorities in 1476, but probably a century later. It contains, if still extant, about 125,000 volumes.

Holland.— The most important libraries of Holland are the Koninklijke Bibliotheek at The Hague, and the university libraries of Utrecht and Leiden. The Koninklijke Bibliotheek (1798) was formed from the collections of the princes of Orange and the library of the Staats-General, and various smaller collections, which are notably augmented by the bequest of Baron van Westreenen in 1848. It numbers some 600,000 volumes, comprising a very complete collection of Netherlands history. The library of the University of Utrecht originated in a collection brought together by the town council in 1581, but its true establishment was probably the date of the foundation of the university in 1636. It contains many rarities in its collections, among them the famous «Utrecht Psalter.» Its collections number about 400,000 volumes. The University of Leiden, founded as a memorial to the brave and successful defense of the city against the Spaniards in 1574, was long one of the most noted in Europe, and immediately upon its establishment by William of Orange (1575) steps were taken to develop a library. This has been augmented by books from many sources, particularly by bequests and gifts from its distinguished scholars such as Grotius, Vossius and Joseph Scaliger, Ruhnken and Hemsterhuis. In 1877 the Library of the Society of Netherlands History was merged with it, forming a notable collection of national history and literature. It is also strong in Orientalia, Greek manuscripts and early Dutch travels. Its collections number 400,000 volumes, 6,000 manuscripts.

RUSSIA.

"The first library ever known in Russia was organized in the 11th century when the great Duke Yaroslaw, the Sage, ordered several books on religion to be copied and kept in the Church of Saint Sofia, at Kief." (Mme. Haffkin-Hamburger, 'Russia Libraries,' in *Library Journal,* March 1915). The principal libraries of Russia originated in the spoils of war. This is particularly true of the Imperial Library at Petrograd. Its first collections were seized in 1714 in Courland, and its true establishment dates from the transfer of the great Zaluski collection from Warsaw in 1796. It is perhaps true that the collection was deteriorating in Poland, yet that only in part justifies the transaction. This collection was formed by Counts Josef and Andrei Zaluski, who had devoted their lives and great wealth to its accumulation, and when opened to the public in 1747 it probably numbered about 300,000 items. The addition of this to its other collections made the Imperial Library one of the largest in the world, a position it still maintains. Among the many collections of which it was formed may be noted those of Catherine the Great, containing Shcherbatof, Voltaire and Diderot, the Slavonic collections of Tolstoi, Tischendorf manuscripts, including the wonderful Codex Sinaiticus, Dolgorousky's Orientalia, the libraries of Adelung, Tobler, and Jungmann and the collections of the Jesuits' college of Polotzk. The library was opened to the public 2 Jan. 1814. The development of the collection was due in large part to the librarians of Olenin and Korff, the increase during the latter's administration being remarkable, growing from 640,000 volumes to over a million. There is a catalogue in manuscript, and lists of special collections have been published from time to time. The collections number 2,615,374 volumes and 207,816 manuscripts.

Other large collections at Petrograd are the Academy Library (1725; 200,000 vols.); Archives of the Senate (4,061,042 vols.); Goruyi Institute (1773; 250,000 vols.); Imperial Academy of Science (1728; 500,000 vols.). At Warsaw is the library of the Polish Kingdom (1,749,837 vols.). Moscow has also some large collections of books, notably the Rumiantseff Museum (1828; 1,000,000 vols.) and the Duchovanja (1689; 240,000 vols.). Russian universities have also extensive libraries, Charkov (1804; 240,916 vols.); Helsingfors (1640, 1827; 150,000 vols.); Kiev (1832; 500,000 vols.); Moscow (1756; 394,845 vols.); Odessa (1865; 280,144 vols.); Imperial University, Petrograd (453,772 vols.); Warsaw (1817; 576,387 vols.). The university at Tomsk, Siberia, has a collection of 226,167 volumes.

There are a few special libraries of interest, the majority being in Petrograd. *Agriculture:* Archives of the Department of Agriculture (1837; 300,000 vols.); library of the College of Agriculture and Forestry at Novaya-Alexandriya (79,374 vols.). *Law, etc.:* Archives of the Senate (4,061,042 vols.). *Theology:* Clerical Academy, Kazan (1842; 106,666 vols.). *Science and Technology:* Archives of the Department of Roads (140,000 vols.); Imperial Academy of Science (1728; 500,000 vols., 13,000 MSS.); Russian Geographical Society (70,000 vols.). *Medicine:* Academy of Medicine (1725; 200,000 vols.). There has been no particular development of popular libraries in Russia, but during the last 10 years efforts have been made to establish them.

SCANDINAVIA.

Prior to the latter part of the 19th century there was no general interest in library development in the Scandinavian countries. There were a few collections in the larger cities and the universities possessed libraries, but none of these were extensive. During the last few decades, however, there has been an awakening to the value of the library to the community and Scandinavian librarians have gone abroad, especially to America, to study modern systems.

Denmark.— The most important Danish libraries are at Copenhagen, the largest being the Royal Library (Det Kongelige Bibliothek), founded originally by Christian III in 1533–39, but re-established by Frederick III in 1665, who erected the building in which it was housed until 1906 when it was transferred to a new home. It is essentially a national library and possesses a most complete collection of Danish literature and history. Among its treasures are the manuscripts of the astronomer Tycho Brahe. Its collections number about 770,000 volumes.

Next in importance is the Universitets Bibliotheket, the oldest research collection in Denmark, having been founded in 1482, the foundation date of the university. The collections were burned 1728, but soon reconstituted. It contains the famous Arne-Magnean collections. The collections number some 400,000 volumes, 150,000 theses, 6,500 manuscripts, rich in medicine and science.

Copenhagen also contains some special libraries of importance (law, history and economics), the Town Hall library (local history), the Royal Veterinary and Agricultural College (agriculture) and the Academy of Fine Arts. There are also several collections on military and naval sciences, aggregating about 100,000 volumes. The only large collection outside of the capital is at Aarhus, which contains 200,000 volumes. A new building was erected for this in 1902. During the last decade of the 19th century a movement was initiated to establish popular libraries throughout Denmark. Prior to that time there had been a few parochial collections in cathedral towns, but they were relatively inactive. The new movement invigorated these and resulted in the establishment of many new collections, hence there were some 500 of these in 1904, with an aggregate of 200,000 volumes. The libraries are controlled by a state library commission.

Norway.— The chief library of Christiania is that of the University. It contains about 500,000 volumes and was founded by Frederick II in 1811, its first collections being duplicates from the Royal Library. Next in importance is the Deichmanske Bibliothek, the free public library. This was established in 1780, reorganized in 1898 and contains 126,638 volumes; Bergen (1872; 117,831 vols.) and Trondhjem (1760; 132,000 vols., 1,940 MSS.) are the other libraries of importance in Norway. The formation of small public libraries has been encouraged since the municipal reform of 1837, but their growth was slow prior to the reorganization in 1901, since which time the development has been more rapid. They number about 1,000. The books for these collections are purchased co-operatively.

Sweden.— The most important collections of Sweden are the Royal Library (Kungliga Biblioteket) at Stockholm and the university libraries at Upsala and Lund. The Royal Library has a somewhat unusual history, for it has been established three times. Gustavus Adolphus presented the original collections, founded in 1585, consisting of books confiscated from monasteries, to the University of Upsala. Another collection was then developed from other libraries conquered during the Thirty Years' War. This Queen Christina gave the Vatican upon her abdication, where it now remains among the treasures of that library. The third collection was, in the main, destroyed by fire in 1697, about one-third being saved. It grew slowly during the 18th century, but the gift of the Royal Antiquarian Collections in 1786 added 30,000 valuable books to the shelves. Its collections now number about 400,000 volumes and 1,000,000 pamphlets. A new building was erected in 1882. Owing to the efforts of the librarian, G. E. Clemming, the collection of Swedish history and literature is very complete. At Stockholm is also the Kungl. Svenska Vetenskapsakademie or the Royal Academy of Science. This was established in 1739, the naturalist, Linnæus, being one of the founders. Its collections number about 115,000 volumes and contain among other items of interest the manuscripts of the Swedish scientists, Swedenborg and Berzelius. The Nobel Institute, which awards the Nobel Prize, has a valuable reference library, and in addition there are several special collections of importance, particularly that of the Royal Statistical Office. The library of the Royal University at Upsala is perhaps the oldest in Sweden, having been established in 1477. It was reconstituted in 1593, but its present development dates from 1620, when Gustavus Adolphus presented the Royal Library to the university. It contains the magnificent De la Gardie collection, received during the latter part of the 17th century. The collections number about 400,000 volumes, to which may be added hundreds of thousands of theses. The library of the University of Lund was founded in 1666, being based on the old collection of the cathedral of Lund. It has been supported by the Swedish rulers and numbers 200,000 volumes. Gothenburg and Linkoping each have public libraries containing more than 100,000 volumes, the latter possessing some interesting manuscripts.

Spain and Portugal.

Spain.— The interest shown in libraries in Spain, prior to the end of the 19th century, has not been very keen. Indeed many old collections have stood still or deteriorated. Recently, however, there has been a revival, particularly in the larger cities, and considerable advance has been made in augmenting the collections and in improving their administration. Madrid, of course, has the richest collections, the Biblioteca Nacional being the largest and most important library in the kingdom. This was founded in 1711 by Philip V, being based upon the royal collections. It has occupied several buildings; the present one, the only one constructed for its purpose, was erected by Fernando VII in 1826. The collections number about 700,000 volumes, 2,057 incunabula, 30,000 manuscripts, and contain much valuable and interesting material on Spanish history and literature, especially early discovery and exploration. Madrid has 23 libraries in all, containing collections aggregating 1,500,000 volumes, among which may be noted the Biblioteca de Universidad Central (1508; 270,000 vols.) and the Real Biblioteca (100,000 vols.). In the environs of the city is the famous library of the Escorial (q.v.). The universities of Barcelona and Seville also have excellent collections.

Portugal.— The National Library of Portugal at Lisbon was founded in 1796 and numbers about 400,000 volumes, 16,000 manuscripts. It is based upon monastic collections. Another notable collection is that of Academia das Sciencias (1779), numbering 120,000 volumes. Oporto has a public library, founded 1833, of 200,000 volumes, and the university at Coimbra (1591) has a collection of 100,000 volumes.

Switzerland.

Switzerland has many libraries (5,798 in 1917) in comparison with its population and area. Only seven of these, however, contain more than 200,000 volumes. The majority of these are cantonal or communal collections. There are, however, 1,335 devoted to science or technology. This showing is all the more remarkable as the state did not concern itself with library development until the first half of the 19th century. A few of the ancient monastic collections of Switzerland still exist, the most interesting being the library of the famous abbey of Saint Gall. This collection was established by Abbott Gozbert about 820. «There remains enough of the old collection to attract and gratify the student of mediæval literature.» Edwards, ‹Memoirs of libraries› (Vol. I, p. 262).

The largest collection is the Oeffentliche Bibliothek at Basel (1460), which contains about 330,094 volumes, 175,000 pamphlets, 5,140 manuscripts. This was united with the university in 1905. The National Library (Bibliothek Nationale Suisse) is at Berne. It was founded in 1895 and already has collections numbering 225,500 volumes. The city library (Stadt Bibliothek) has about the same number of volumes. Freiburg i. U., Geneva, Lausanne and Zürich each has a public library of over 200,000 volumes, while Zürich has in addition a library of technology in connection with the Technische Hochschule. Zürich also is the headquarters of the Consilium Bibliographicum, the purpose of which is to develop a universal card bibliography of scientific literature. The Swiss libraries are also co-operating in the formation of a general catalogue of Swiss literature, the libraries at Berne and Lucerne forming the collections upon which it is based. A Swiss library association was organized in 1900.

GREECE.

There are two libraries of importance in Athens, the Chamber of Deputies library (160,000 vols.), and the National Library (1842; 314,000 vols.).

ASIA.

Japan.— The early history of libraries in Japan is involved with that of China and presents no important distinctions. During the last quarter of the 19th century, however, the great transformation produced in Japan by the introduction of Western ideals and methods has had an influence equally far-reaching upon the libraries. These are now modeled upon accepted modern systems and a number are large and very active.

The most important is, of course, the Imperial Library at Tokio, founded in 1872. This is a reference library and contains about 298,663 volumes, of which one-half are Japanese and Chinese works. There are several other large collections in Tokio, among them the University Library (1872; 491,082 vols.); the Imperial Cabinet Library (1885; 507,500 vols.); the Hibaya Library (1908; 153,000 vols.); and the Waseda University Library (1902; 151,000 vols.).

There are also large libraries at other places, notably the Imperial University Library (291,117 vols., mainly technology) and the Fukuoka Medical College (113,000 medical works) at Kioto. Osaka has a public library containing 109,186 volumes, of which 8,218 are in the native tongues. There are, in addition, collections of books in nearly all the cities and towns. None of these are large, but the government is encouraging their development in every way, and undoubtedly the future of Japanese libraries is bright.

China.— Very little is known regarding the library history of China, yet it is believed that collections were formed at an early period. Huang-ti, one of the semi-mythical emperors, is said to have organized a board of historians to collect and transcribe the records of the empire. It is known, too, that the so-called «First Emperor» (221 B.C.) decreed that all books save those on medicine, magic and agriculture should be burned, and himself took charge of the censoring of the books. It was only through concealment that many treasures of Chinese learning, including the works of Confucius, were saved from destruction. Hsiao Wu (139–86 B.C.) established what were known as «Repositories,» the Chinese equivalent of the modern reference library. During the first century before Christ, Liu Hsiang (80–9 B.C.) and his son were commissioned to transcribe the masterpieces of Chinese literature and form a library. An annotated catalogue resulting from their labors which contains 11,332 entries is still extant.

There are also records of Chinese travelers, particularly Buddhist priests, who brought books from India and elsewhere into China and translated them into the vernacular. Of these Fa Hsien (circa. 400 A.D.) and Hsuan (629 A.D.) are of especial consequence.

The National Library at Peking was formed originally from a collection of 100,000 bamboo books and the Shu King, which had been concealed from destruction. These were added to by successive dynasties, but suffered many losses by fire and war. At present the library has about 200,000 volumes and manuscripts. There are collections at Canton and other cities. These are mainly for reference use only. There are a few small modern libraries in China, the one at Boone University being of some importance.

India.— There are many libraries in India, both native and foreign. Few, however, of them are of considerable size. The largest collection is doubtless that of the Imperial Library, Calcutta (1891; 152,000 vols.). The Royal Asiatic Society has collections at both Calcutta and Bombay, the latter numbering 80,000 volumes. In general, particularly in the British ruled states, the interest in libraries has not been very keen, the greatest development along modern library lines being in a few of the native states. A most remarkable instance is that of the state of Baroda. The library movement here was initiated by the Maharaja of Baroda, a highly enlightened and clear-visioned ruler. Under direction of an American librarian, Mr. Borden, a modern library system has been established which comprehends every portion of the state, all administered from the Central Library, a reference collection of 200,000 volumes housed in a beautiful building, a former palace of the Maharaja. All the libraries are state supported, and free to everyone without restriction of caste or position. A library school has also been established for training native librarians.

The only other state having a free library system is Indore. There are libraries at Madras, Benares, Allahabad and other cities but they are mainly used by scholars. A number of the native princes have made it a point to collect manuscripts, that of the Rajah of Tanjore being famous for its Sanskrit rarities. Eight thousand of its items are written on palm leaves.

Siam.—As a memorial to their father, the children of King Mong Kut founded a library in Bangkok. This was enlarged in 1904 and made the depository for the national archives. Its collections are divided into three sections: works in foreign languages, native languages and ancient languages. The last is of particular interest and contains over 100,000 items, many of them unique. The library also contains a collection of ancient inscribed stones.

HAWAIIAN ISLANDS.

The most important library of the Hawaiian Islands is the Public Library of Hawaii which occupies an attractive Carnegie building at the civic centre of Honolulu. It grew out of a merger of several libraries, the Honolulu Library and Reading Room, founded in 1878, forming the bulk of the collection. The new building was occupied in 1913, and the library was made free to all in 1914. Oahu College has a growing collection housed in a $75,000 building, the gift of C. M. Cooke.

PHILIPPINE ISLANDS.

There were collections of books in the Philippine Islands prior to the American occupation, the most of them developed by the Church. None of these, however, appear to have been of great importance. The first modern collection established was that of the American Library at Manila founded through the efforts of Mrs. Charles R. Greenleaf, the wife of General Greenleaf, and based upon books contributed by the Red Cross Society of California. This was turned over to the Philippine government in 1901 and is now under direction of the Bureau of Education. It is housed in a large building constructed by the Spanish government. The Bureau of Science also has an excellent collection, which is rich in material relative to the resources of the Philippines.

AUSTRALASIA.

Australia.— Great interest in libraries has been evidenced in Australia, virtually all of which are state supported. The most important libraries of Australia are the New South Wales Public Library, Sydney (1869; 258,742 vols.), the Victoria Public Library, Melbourne (1854; 254,756 vols.) and the Adelaide Public Library (85,804 vols.). The Victoria Library is housed in a splendid new building, erected in 1915. There are two modern university libraries, the Sydney University (100,000 vols.) and the Melbourne University. Tasmania has also established a system of public libraries. While none of these are large they are growing rapidly. The largest collection is the Public Library of Hobart, containing about 50,000 volumes. A library association was founded in 1902 and reorganized in 1911.

New Zealand.— New Zealand is not less alive to the value of libraries, which have been encouraged by very liberal library acts. The four largest centres of population, Auckland, Wellington, Christ Church and Dunedin, each has an excellent collection, the largest being the Auckland Free Public Library with approximately 100,000 volumes. Dunedin Library is housed in a Carnegie building erected at a cost of $50,000. Trained librarians, only, are employed in New Zealand libraries, whose interest in their work is shown by the organization of a library association in 1910.

AFRICA.

Although there are a few libraries in northern Africa, such as the Bibliothèque Universitaire (58,620 vols., 135,252 theses) at Algiers, and the Bibliothèque Khediviale (75,000 vols., 12,000 MSS. at Cairo, it is only in South Africa that any noteworthy progress is evidenced. This has been encouraged by the enactment of library laws, the first being an ordinance passed by Cape Colony government in 1818 establishing the South African Public Library at Cape Town. This was given the copy-privilege in 1836. Grants of money have been made from time to time. The library is very rich in local history, due in part to the bequest (1862) of the large collection of Sir George Grey, the famous colonizer. Collections of books are to be found in nearly all of the South African centres, notably Fort Elizabeth, Durban, Kimberley, Johannesburg, etc. See also LIBRARY DATA; LIBRARY PERIODICALS.

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LIBRARIES, Rural. See RURAL LIBRARIES.

LIBRARIES, Special. Commercial and Industrial.— Industrial and commecial libraries are now found in manufacturing and business corporations of all kinds. Their purpose is to supply managers, heads of departments, foremen, clerks and workers with information and suggestions. They are not parts of the equipment for the welfare work (q.v.), which is carried on in many plants for the comfort, convenience and education of employees, though they are sometimes closely allied to that equipment.

These libraries are one of the results of the recent rapid development of certain manufacturing, commercial and financial methods and of extensions and modifications of the use of print in the preservation and distribution of knowledge. They are so recent that they have no history, save as it is suggested in a statement of the factors which brought them into existence.

The movement toward concentration and specialization in production, distribution and allied industries, which began with the invention of the steam engine, has been very rapid in the last few decades. Many industrial leaders have seen the modest businesses they helped to establish grow rapidly into vast organizations, employing thousands of men and handling millions of dollars annually. This has been true in railroading, water transportation, mining, farming, manufacturing of all kinds, finance, insurance, construction and many other industries and occupations. The central offices of these large enterprises have developed many and varied methods, devices and tools to meet their respective needs, and to help to keep under proper control the infinity of details that threaten to consume the time, thought and energy of those creative, inventive and managerial minds whose undisturbed activities are absolutely essential to the continued success of any great enterprise.

The demands from these central offices and from other sources for suggestions and advice in the field of business,— and by business is here meant management of persons and things and not the science or technique of making or transporting things,— led to a rapid increase in the production of books and journals of business,— the first journal specifically devoted to business appearing about 30 years ago.

Before industry had entered on its swift modern development, trade and technical journals were relatively few and unimportant. Expanding industries demanded journals which should tell of that expansion and give to managers, department heads and special workers, who were often men of great native ability but of limited education, all obtainable information and suggestions in the fields of technique, science and management. Trade journals grew rapidly in number and in value. Within each industrial field soon appeared journals devoted, some to labor in that trade, some to production, some to distribution and to consumers. Meanwhile, book production on all aspects of industrialism grew rapidly.

This, then, was the situation about 15 years ago: thousands of industrial and commercial organizations were expanding rapidly and daily meeting new conditions and new problems. They demanded of their creators, managers, experts, salesmen, advertisers, heads of departments, foremen, clerks and laborers greater efficiency, fresh ideas, new devices and broader views. To the offices of these organizations came, almost haphazard, a few books and journals, and these were read by a few and treated at haphazard. They were helpful to some but gave slight assistance to most.

Then came industrial and commercial libraries. Great organizations found that they needed, for their proper growth, all the knowledge, wisdom, technique, science and suggestion anywhere to be found; that they needed to know every day all that all inquirers, in the special field of each organization, had learned the previous day; that they needed to know of all experimentation by others that they might avoid costly experiments for themselves; that they needed, in fact, as complete a collection as could be made of the recent, and of some of the older, books, journals and pamphlets on their activities; that they needed not only to have these at hand, but also to have them so arranged, filed and indexed as to bring out all they contained of value to them; and that they needed to have that part of their contents which particularly fitted their work digested, arranged by topics and presented daily, weekly or monthly to all the directors of special activities in their whole army of workers.

A commercial or industrial library, then, is the resultant of two things,— the great modern growth of organizations and the great modern flood of business, technical and scientific literature; and it is, briefly, a carefully controlled collection of such printed material, relating to the work of the organization which it serves, as a librarian, expert in print, and his assistants can gather, index, digest and present to all its personnel.

The development of these libraries is not an isolated phenomenon. In the same three decades in which they have appeared in large numbers, libraries of the older types have increased in number, size and effectiveness, and have extended their fields of work. The demand of the industrialist for the latest word on his industry was one of the immediate causes of the coming of the industrial library; but other and more general causes were, of course, behind this proximate one. Extension and improvement of public schools; education through newspapers, journals and cheap books, in the use of print and in the habit of learning; growth of the habit of travel, and many other factors, all helped to make over the old type of library and to create new types. About 40 years ago free public libraries ceased to be mere storehouses and began to ask to be used, that is, to advertise. Soon they allied themselves to schools, and vastly widened their fields. High schools awoke to library needs and installed special libraries of their own. College and university libraries began to adopt new and broader methods. State libraries, herein anticipating and in a measure suggesting the industrialists' libraries, began to make themselves useful and indispensable to state officers and legislators.

Industrial and commercial libraries can be well understood, their quite inevitable character and purpose clearly visualized and their short history easily grasped, in the light of the broad movements thus briefly noted.

These libraries have grown in number so rapidly and so quietly in recent years that a census of them would be difficult to make and would be inaccurate the day after its completion. Those who were in charge of a few of the more important ones formed, 10 years ago, a Special Libraries Association, using the word "special" because their work is in most cases confined to a special field, that of the operations of the corporations which respectively employ them. In 1910 this association founded a modest journal, called *Special Libraries,* whose nine volumes contain most of the published literature on the subject of this article.

Large and small corporations engaged in the following, and many other, industries and businesses, have established libraries of the kind under consideration: Banking, insurance, public utilities, manufacturing in many lines, department stores, wholesale houses, statistical establishments, engineering experts, electrical experts, bureaus of standards and economics, civic and commercial bodies.

The list can be extended. But it is long enough to show that the movement toward gathering special knowledge for the special needs of special groups of workers is as broad as are industry and commerce themselves.

These libraries collect anything printed or in manuscript which is proper to their respective purposes. Some consist almost entirely of typed, written and printed sheets and leaflets, kept in filing cabinets. Some are made up almost solely of pamphlets and of articles clipped from papers, journals, all classified and indexed.

Some are composed chiefly of journals and proceedings, and some contain little save books. Most of them adjust both collections and methods of handling to the fact that to-day the majority of the more valuable contributions to human knowledge,— and knowledge is here used in its widest sense — appear first in journals and publications of societies and are unbound. These, being clipped or pulled apart, form a collection of leaflets and pamphlets, capable of being closely classified and compactly and conveniently stored in filing cabinets, with manuscript and typed notes and data added as the corporation activities and needs suggest. That is, the industrial or commercial library tends more and more to the method, in its acquisitions, of taking from a vast annual mass of print only so much as is quite specifically related to the activities of the corporation which maintains it.

These libraries are usually located close to the central offices of their respective corporations. They are, in many cases, put in charge of experts in the art of mastering printed material. Under general instructions from a manager, the expert studies the field of print; gathers what is proper for the corporation's needs; puts it in systematic form by classifying and indexing processes; and, each week or each month, makes brief abstract sheets of such articles or books or parts of books as his knowledge of his corporation's activities leads him to think will be useful, and places these sheets in the hands of such executives, experts, foremen and heads of departments as may find them of value.

REFERENCES.

The following list of references is not in any sense intended to be inclusive even of larger industrial and commercial libraries. Only those mentioned several times by authorities are listed. The list merely suggests the application made in these days of the library idea to all branches of industry and business, and will serve as a directory to those seeking information on the subject.

A list of special libraries appears each year in the 'American Library Annual,' $5, R. R. Bowker Company, 241 West 37th street, New York city. Gives brief statement about each library.

New York Special Libraries Association maintains an employment registry and a permanent exhibit of forms and methods used by members of association at the Municipal Reference Library, Room 512, Municipal Building, New York city.

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«Bibliography of Articles Relating to Industrial Libraries» (in *Special Libraries*, February 1911, p. 12).

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Special Libraries, published by the Special Libraries Association, monthly, 1910 to date, 70 Fifth avenue, New York City. Subscription, 10 issues, $2.50; single copies, 25 cents. Principal source of information.

Public Affairs Information Service. H. W. Wilson Company, 958 University avenue, New York. Indexes articles and books about industrial and commercial libraries and announces establishment of new libraries, etc.

Some Leading Firms and Institutions Maintaining Commercial Libraries.

Financial.—American Bankers Association, New York; National City Bank, New York; Guaranty Trust Company, New York; Fisk and Robinson, New York; Farmers' Loan and Trust Company, New York, etc.

Public Utilities.— American Telephone and Telegraph Company, New York; Stone and Webster, Boston; H. M. Byllesby Company, Chicago; Boston Consolidated Gas Company; Boston Elevated Railway Company, etc.

Manufacturing.— Brighton Mills, Passaic, N. J.; B. F. Goodrich Company, Akron, Ohio; Studebaker Corporation, South Bend, Ind.; General Electric Company, Schenectady, N. Y.; National Cloak and Suit Company, New York; Goodyear Tire and Rubber Company, Akron, Ohio; National Cash Register Company, Dayton, Ohio; Winchester Repeating Arms Company, New Haven, Conn.; Robert H. Ingersoll and Brothers, Brooklyn, N. Y., etc.

Dry Goods Stores.— Marshall Field and Company, Chicago; William Filene's Sons Company, Boston, etc.

Commercial Organizations.— Philadelphia Commercial Museum; Merchants Association, New York; National Automobile Chamber of Commerce, New York; Chamber of Commerce of the United States, Washington, D. C., etc.

Government Departments.— Bureau of Standards; Bureau of Foreign and Domestic Commerce; Bureau of Railway Economics; Library of Congress; United States Forest Service; Federal Trade Commission, etc.

Special Departments in Public Libraries.— Technology department, Carnegie Library, Pittsburgh; business branches of public libraries in Newark, N. J., Saint Paul, Minn., Indianapolis, Rochester, etc.

Miscellaneous.— Sears-Roebuck Company, Chicago (mail order); Curtis Publishing Company, Philadelphia (advertising); McGraw Publishing Company, New York; Retail Credit Company, Atlanta; Youth's Companion, Boston (editorial); Price, Waterhouse and Company, New York (accountants); Arthur D. Little, Inc., Boston (chemists); Detroit News (newspaper); Harvard College, School of Business Administration; A. W. Shaw Company, Chicago, etc.

Consult also following journals: *Library Journal,* 241 West 37th street, New York, monthly, $4 a year. *Public Libraries,* 6 North Michigan avenue, Chicago, monthly except August and September, $2 a year. *Library World,* 8 Coptic street, Bloomsbury, W., London, England, 6d. *Library,* 32 George street, Hanover Square West, London, England, 3s. *Library Assistant,* Shepherds Hill Library, Highgate, North, London, England, 4s. *Library Association Record,* Caxton Hall, Westminster, London, England, 2s. *Special Libraries,* 70 Fifth avenue, New York, monthly except July and August, $2 a year.

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LIBRARIES, Traveling. See TRAVELING LIBRARIES.

LIBRARY ADMINISTRATION. In recent years the conception of a library's field and functions has grown so rapidly that library administration has become a recognized science with problems vastly broader and deeper and demanding well-equipped professional schools giving systematic instruction to those in whose charge the leading libraries will be placed.

Certain library schools now require for entrace a college degree; in others the course is a regular part of the work of a college. Many colleges and normal schools conduct courses in bibliography and elementary library administration to enable students to use library facilities to the best advantage or to take charge of school libraries in connection with teaching positions. There are also numerous summer courses for those already engaged in library work and classes in individual libraries to train their own assistants. There is a growing movement, vigorously supported by the library profession, for certifying librarians, as we do teachers; and several States have already passed laws requiring tests or a certain degree of training or experience for some classes of library positions. This has greatly improved the librarian's status. In salaries, hours of service and vacations he has his place beside other educational officers, as the public recognizes that in general education, professional training, executive capacity and all factors which determine salary, the successful librarian should rank with the highest educational officer of the same community. In a college the proper salary of the college librarian is that of a full professor. In a university he should rank with deans of departments and in public libraries with superintendents of schools or high school principals. Usual daily hours are now seven and usual vacation one month.

Functions.— The chief function of the old library was to get all the books it could and preserve them safely. The modern library does this also, but has placed free public use infinitely above getting and keeping. First the word library meant any collection of books. It is now losing that sense and means the community intellectual headquarters for not only books and pamphlets, but also periodicals, newspapers, maps, pictures, music scores, player rolls, phonograph records and other material for information on subjects of current interest, as well as coins, medals and collections illustrating science, history or art. It is no longer a reservoir whose chief function is to take in and accumulate, but a fountain. Its work is no longer passive, but aggressive. The modern librarian is as anxious to put his wares before the public and have his books and other material used as is the store or factory to secure custom for its goods. He tries to attract the attention and rouse the interest of every resident or transient, child or adult, by bulletins, by book lists and notices in newspapers and in shop and office pay-envelopes, by exhibits, by floats in parades, by posters in hotels and other public places, by talks and by any other creditable means of «library advertising.»

We have learned that reading is the greatest engine human genius has evolved. It grows constantly in importance. While most reading is better than most conversation, it is as powerful for evil as for good, so that the greatest problem for educators and statesmen is to develop in youth a taste for the best reading and to supply it free through life. Hence, development of a children's department in public libraries and fostering of school libraries.

Reading has three great functions: (1) To inform, so that one may stand on the shoulders of all his predecessors and utilize their labors and experience in any subject. This cumulative wisdom of the race passed on in books makes possible the marvels of civilization. Books give this information which builds material prosperity. Increasing interest in vocational books and development of business and other special libraries powerfully stimulate this function. (2) A still more vital function, but less tangible, is the inspiration which lifts up and builds character, the work of the books of power, the books of all time. (3) The last great function is to afford rest and recreation for the tired and overworked to fit them better to carry life's burdens. The free public library is the only practicable method for shaping this reading, which in its threefold form of information, inspiration and recreation is the greatest influence in modern life.

Children's Department.— This aims to interest children in books, to develop taste for good reading, to establish the «library habit,» to co-operate with schools, and, incidentally, to teach how to use reference books, indexes, catalogs and other bibliographic tools. It ranges from a few separate shelves or an alcove in the general reading-room to one or more separate rooms in charge of a specially qualified children's librarian. Users may include children of all ages up to those beginning to appreciate adult literature. Besides an attractive collection of carefully selected books, there should be tables, chairs and other furnishings adapted to users of various sizes. Specially effective is the story hour, conducted by the children's librarian or some other childlover skilful in rousing interest in reading among those not naturally so inclined and in selecting from the great classics what appeals to children and also in interesting them in the daily events of world importance.

Work with Foreigners.—The public library should be a strong Americanizing factor where there is a considerable foreign population, often largely of those who can read only their own languages. Among many means are: (1) Books in their own languages and in simple English to which access is made easy by: (2) branches and deliveries in immigrant districts; (3) lectures and story telling; (4) classes in English and elementary civics.

It is in leading foreigners to read books in English that librarians meet their greatest obstacle. Spoken English is easily learned, but in print appears a new language, with words not spelled but made up of arbitrary combinations of letters incapable of being explained or reduced to rule, and condemned by English lexicographers and philologists as unetymologic, unphonetic and altogether indefensible. Simplifying English spelling is vital to the librarian's highest success, for his treasures are useless to foreigners till they take the meaning readily from the printed page.

SPELLING REFORM.

School Libraries.— These are in school buildings to provide, close at hand, reference and other books supplementing school textbooks and aiming to stimulate interest in curriculum or, like children's departments, to develop taste for good reading. These are sometimes a public library branch or deposit station, sometimes managed jointly by the school and the public library and sometimes owned and managed by the school. For lower schools the branch system works best, while high schools tend to have their own libraries, with trained librarian specially qualified to influence students' reading habits and to teach them how to use the library. Among States leading in development of school libraries are New York, New Jersey, Michigan, Wisconsin, Minnesota, California and Oregon.

Administration.— Books and other suitable material are no more a library than a pile of bricks is a building, or a mob of men is an army. To be effective there must be such arrangement and organization that its great functions can be performed promptly and efficiently without undue cost. Experience proves that to make books into a successful library the chief factors are in order of importance: (1) Librarian; (2) methods; (3) building. Because it is most prominent and readily understood by the inexperienced, the least important is usually thought of first.

Library Buildings.— To compete successfully with places of amusement the library should be as accessible as possible, but preferably a few steps off the main street for greater quiet. Books increase in a ratio beyond the plans of architects and librarians, and few libraries provide adequately for growth, either for books, readers or administration. Good natural light and ample room for growth are essential. Steel, glass, brick, stone, concrete and tile are the best materials for large libraries, but fireproof construction is important only for central libraries which preserve rare books not readily obtainable in open market. The most needed best books should be housed within easy walking distance of every citizen. This requires in larger towns branches or deliveries at convenient points. The most used books should be freely accessible in reading-rooms; but economy and convenience both demand that the main supply should be kept in stacks. In a standard storage stack the cases are double-faced and only 75 centimeters apart; but in small libraries cases may be 120 centimeters (4 feet), apart, to invite public access. Each case is 8 or 7 shelves high and 5 tiers long, thus giving 80 or 70 shelves on its two faces. Each foot, shelves about 7 books, so each foot of wall, 7 shelves high, holds about 50 books. Each foot of double-faced case holds 100. Each shelf is better 75 centimeters long, rather than 36 inches; 20 centimeters (8 inches) deep, and 25.5 centimeters (10 inches) high, thus taking all books up to the largest standard (8vo.) which by library rules is limited to 25 centimeters. These cases make a one-story stack, with every book within reach without ladders. Steel is better than wood for tall stacks (sometimes 10 stories) and grows steadily in favor because it is strong, compact, clean, fireproof and more open for light. An atmospheric steam heat is best as it can be regulated as closely as hot water and does not annoy readers by cracking or hammering. Electric light should be provided on all reading-tables. Indirect lighting has removed the most serious objections to high lights, but for greatest comfort a reader should have a light under his control and near his book. When the stack section can have abundant daylight, it should be of glass with only steel or masonry enough for support, with glass always opposite aisles; but if it has only electric light, it should be well and draftlessly ventilated both for welfare of books and of persons working in it.

Spiral stairs are costly, wasteful and inconvenient. Straight stairs under which space can be used for shelves take less space. Doors to bookcases are worse than useless and have been abandoned except for rare, costly or restricted books. Tables and desks should be 78 centimeters high, not 75 centimeters as usual; for short people can use higher chairs, but tall people cannot shorten their legs. Skilful arrangement of rooms will greatly reduce cost of administration. Permanent partitions should be used only where necessary for support. Temporary partitions, usually glass, can be readily moved as growth requires. These allow better light and supervision from another room, while shutting off noise, and give a more spacious look. In small libraries, departments for adults, for children and for selection and delivery of books may be included in a single open room, separation being marked by bookcases not more than four feet high, the whole under direct central desk supervision. Consult 'Carnegie Corporation Notes' for valuable suggestions.

Most important after the central rooms are first a quiet study-room, then a children's room. Even small libraries need one or more class, or lecture rooms for clubs, classes and meetings which find their natural home at the library. Larger libraries require a growing number of special rooms for newspapers, art, patents and various other needs of the staff and public.

Acquisition.— Bookbuying for a small library is simple, requiring mainly selecting an agent and arranging for discounts. A large library, buying thousands of volumes yearly, has often several agents for home and foreign buying, including auction sales, and requires accurate financial and order records with carefully elaborated routine to prevent confusion, error and waste of time. Large libraries often add by exchanging their own publications and duplicates with other institutions. In libraries of every size, gifts from individuals as well as from societies, institutions and government departments, if tactfully sought and appreciatively acknowledged, are a large and valuable annual increase.

Book Selection.— In selecting from the vast flood of books, pamphlets and periodicals constantly printed the chief considerations are: (1) Needs, interest and tastes of the community; (2) funds available; (3) merits of individual books. While every general library must have general cyclopedias, dictionaries, atlases, etc., and some books on the most important subjects, many communities have distinct interests, industrial, sociologic or cultural, which should be specially fostered. Funds available should be apportioned among various subjects and must often determine whether to buy a special work. Deciding on a particular book depends on: (1) Importance of its subject; (2) its interest to the community; (3) its trustworthiness; (4) its probable influence on character and taste; (5) its style (whether interesting or dull); (6) for fiction, the interest of the plot or theme; and (7) its physical make-up, specially type and quality of paper. Some of these factors the librarian must decide, but his knowledge of reliability and probable influence of the books usually depends on outside aid, personal or printed.

Need of printed guides has been partly met by bibliographies, catalogs and lists to help determine quickly what is best to buy, its cost, where and by whom published and perhaps to track it through auctions and stores. Many think of these bibliographies as a dozen or so reference books, but their growing numbers run into many thousands. It is one great factor in the professional training of a librarian to learn how to use this extensive apparatus effectively. Of the preceding essential items, 3–7 are covered by the notes forming a regular feature of most of the following very helpful printed aids. They embody the best from leading English and American reviews, besides much expert individual judgment. (A. L. A. means American Library Association, 78 E. Washington street, Chicago).

On the selection of books consult A. L. A. Catalog, 1904, and Supplement, 1911 (United States Superintendent of Documents); 'Book Review Digest' (Monthly, with semi-annual and annual cumulations); 'Booklist' (10 numbers yearly, A. L. A.); Kroeger, A. B., 'Guide to the Study and Use of Reference Books' (3d ed., 1917); New York State Library, 'Best Books' (annual); Pratt Institute Free Library, 'Technical Books' (annual); Sonnenschein, W. S., 'Best Books' (3d ed., in press, 1910–19); Walter, F. K., 'Periodicals for the Small Library' (A. L. A.); Wilson, H. W., Company, 'Standard Catalog Series'; Wyer, J. I., 'Government Documents in Small Libraries' (A. L. A.); 'Government Documents in State and City' (A. L. A.).

Accessions.— After a book is received it must be made part of the completely organized library which has as its ideal the choice and delivery to each inquirer, with the least possible delay, of the book, pamphlet, article, essay or other item which then and there to him will be most useful.

This is most difficult even in a small library, and in large ones with a million or more items from which to choose, no satisfactory results can be reached without an elaborately organized system, administered as carefully as the details of a great factory or railway, where mistakes and carelessness are intolerable. There are 30 distinct steps in accession department routine alone in a large library before a book is ready to be classified or cataloged. Economists have repeatedly tried to shorten the processes, but after several years' experience usually incur the extra cost of going back and supplying omissions as the only way to avoid the more serious expense of resulting delays and confusion. Ownership is marked by a bookplate inside the front cover with name of library and official marks. The name is also repeated (stamped, embossed or preferably perforated on the titlepage so that it cannot be removed by book thieves, and private marks at some special page, to be found only by one knowing the key, serve to identify lost or stolen books. Call numbers on the back ensure quick finding and replacing on shelves, and most lending libraries put a manila pocket inside the back cover to carry book or reader's card. The accession book is the business record, in which every volume in the library has a numbered line as its pigeonhole for its complete history. The number of this line, the accession number, is stamped on first recto after title, on shelflist and cards, and exactly identifies that particular volume. In trying to escape making accession entries, some librarians use bills, order slips for orders filled or shelf-list; but while these substitutes require less time at the start they lack the accuracy, uniformity, permanence and convenience of the properly kept accession book.

Shelf-list.—As its name implies, this is a list of the books in the order in which they stand on the shelves, and so serves for taking inventory. Since the usual arrangement of books is by subject, the shelf-list serves also as a subject catalog for the main subject of books, though strictly as a shelf-list it contains no references to material in books shelved under other subjects. Such references may, however, be added to the shelf-list in any library where this double use warrants it. A third important use of the shelf-list is as the record of book numbers in each class. Books on the same subject group under the same class symbol are distinguished from each other by a separate book number. This is generally assigned from the author's name, but in some cases, e.g., individual biography, from the subject. Class and book (with sometimes volume or copy) number, together form the «call number,» distinguishing each book from every other in the collection. The shelf-list, by showing immediately what book numbers have been assigned in any group, prevents duplication and consequent confusion.

While the present tendency is toward shelf-lists on cards because they allow exact intercalation and save rewriting, these advantages are counterbalanced by danger of having so vital a record as the library inventory in such form that an entry may be removed without detection and by inconvenience of seeing only one entry at a time in shelf reading. Useful as cards are, they should not be used where business safety, efficiency or ease of reference require sheets or bound books. Rewriting is infrequent when the New York shelf sheet (10 by 25 centimetres, about 4 by 10 inches) is used and when in large classes separate sheets are used for each initial, so that, e.g., if entries in C become too disarranged, as many C sheets can be rewritten as are necessary to restore order without touching B or D. When the shelf-list is on cards and printed cards are used in the catalog, an extra copy may be used for a card shelf-list, thereby duplicating in full the catalog entry; otherwise the shelf-list entry, whether for card or sheet shelf-list, is very brief, including merely class number, book number, author, short title, some distinguishing detail when the library has more than one edition, accession number and volume or copy number.

Classification.— Shelf arrangement of books is now almost universal by subject. A few of the oldest and largest libraries follow their old systems, but most libraries are arranged according to some widely used printed scheme of classification which brings together related subjects, first broadly and second under more or less minute divisions according to amount of material. Adoption of such a generally accepted scheme not only saves the librarian the enormous labor of developing one of his own, but also brings his library into harmony with many others, thereby facilitating both the use of various libraries by the same reader and also co-operative work among libraries themselves. As the same book bears the same class number in each of many libraries using this system there is an immense saving possible by utilizing the work of others. The decimal classification, now most widely used by libraries, has over 20,000 subject headings and many new ones are added yearly. By means of its very full and simple index a book may readily be classed minutely; and may be found with equal ease by one knowing clearly what subject he seeks. The classifier's work involves not only familiarity with the system used, but often also careful examination of the book in hand and acquaintance with scope, relations and terminology of the subject treated.

Author Catalog.— This like all other catalogs and indexes is kept on cards 7.5 centimetres high and 12.5 centimetres long, the size adopted for national and international use and rapidly displacing all other sizes except for peculiar uses. (See OFFICE LABOR SAVERS, *Card Index System*). The author catalog gives under each name all of any author's work which the library has. It is often expanded to include titles of anonymous books, striking titles of other books, biographies, criticisms and reviews, or any topic for which subject entry would be name of person or place. It is then a «name» catalog as it includes more than authors.

Subject Catalog.—This shows what the library has on any given subject. For lack of time or money it records in many libraries only books, but a complete catalog adds pamphlets, articles in periodicals, papers, transactions, essays and collected works, maps and whatever material one studying that topic might want. Subject catalogs arranged by the usual systems of classification are partly indext by the alphabetic index to the classification tables, but continual advance of knowledge outruns possibilities of corresponding printed records, so a printed index needs to be constantly supplemented by new topics, either interlined or separately listed on cards or sheets. It does not matter that a printed index refers to heads lacking in the catalog, for it often leads to valuable related material that might otherwise be overlooked.

Dictionary Catalogs.—The separate logically arranged subject catalog, with its corresponding name catalog, best meets scholarly or technical library needs, but for general public use the dictionary catalog is almost universally accepted. It has all entries (author, title, subject, etc., with references from synonymous and related terms) in a single alphabet like the words in a dictionary.

The author catalog corresponds to personal names in a directory; the classified catalog to the business section showing all engaged in each specific line of business. A dictionary catalog requires least explanation and is most popular, but it is more difficult to make well, and except at prohibitive cost cannot give intelligent investigators as clear and methodic exhibits of a library's resources as a classified catalog. Large libraries have many special catalogs, bibliographies and indexes as keys to their own special collections.

Annotation or evaluation is a most important factor in modern cataloging. Its purpose is to tell in fewest words what readers ought to know about a book's scope, treatment and value; but for such guidance we still depend mostly on printed bibliographies. See list at end of *Book Selection*.

Printed Cards.—There is a great saving by utilizing cataloging done by large libraries which print their cards and make them readily available for others. The Library of Congress prints, with minute bibliographic detail, cards for its own books, which include practically all current American publications through copyright provision, and also many foreign works. Any library may buy these cards (35,000 to 40,000 titles a year) for little more than blank cards. They are author entries, with suggestions for subject and title entries, etc. Libraries adapt them to their own catalogs by any necessary changes in detail and by adding subject or title headings and their own call numbers. Full information is given in the Library of Congress Handbook of card distribution.

Lending.— A loan system must give the quickest service consistent with accurate and complete records. The card system is best. The librarian must know where every book is, when it should be returned and must find delinquents daily. Extra privileges in number of books or time retainable are given during vacations and to scholars having special claim. Many libraries allow more than one book if only one is fiction. Inter-library loans are frequent so that a reader may, when necessary, secure from another library a book not in his own.

For readers impatient of waiting their turn for a free copy some libraries have duplicates of the newest and most popular books to rent for a small fee. Branches, deposit and delivery stations scattered through a city greatly increase library use by those to whom distance from the main collection would be prohibitive. Parcel post and rural free delivery carry the library to the doors of more remote readers, while traveling libraries serve groups such as schools and clubs, or isolated students requiring an unusual number of books for longer time.

Reference.— Libraries grow more liberal in privileges to readers who now find on open shelves books most used instead of having to ask for each book consulted. In many libraries not only so called reference books but thousands of others are thus thrown open. Losses are small compared with benefits, and the practice has become very general, its extent depending mainly on size of library and space available. An information bureau or reference desk in charge of an expert whose sole function is to answer readers' questions is common, while large libraries have a library faculty, each taking some special subject on which he will be a recognized authority. Besides aiding readers at the library, a reference librarian utilizes mail and telephone both for giving and getting information. His department is the clearing-house for information from all available sources. There are special rooms for important subjects, each in charge of a specialist. Rooms for women's exclusive use are little used, women apparently seeing no more need of separation than in churches, lecture halls or theatres. The children's room becomes the best possible training school for supplying readers who will use the library properly. (See CHILDREN'S DEPARTMENT). Special libraries belonging to factories, business or public offices, are increasingly available to all either through co-operation with public libraries or by operation as public library branches.

Paid Help.—A highly appreciated accommodation in some libraries is assistance of an extent or nature not properly provided at public charge, for mere cost of time spent, estimated at rate of annual salary. This saves costly journeys, because an expert trained in a given library can often find as much in an hour as a reader himself would find in a day. Telegraph and telephone make central cyclopedic libraries quickly available for large areas, and editors, lawyers and others whose time is specially valuable may quickly get needed information, and if wished translations, verified or photostat copies or other library service at the trifling cost of the time of the lowest salaried assistant competent to do the work.

Legislative Reference Libraries.—Progressive States have followed New York (in 1890) by establishing a bureau specially for its lawmakers. A librarian versed in political and legal science keeps at his fingers' ends laws and pending legislation of other States and counties, with available discussions, to enable legislators of his State to stand on the shoulders of those dealing with similar problems elsewhere.

Municipal Reference Libraries.—These are essential to intelligently conducted city governments. Through them city officers and public-spirited citizens keep in touch with each other's actual or proposed measures or projects, and the pros and cons of civic questions.

County Libraries.—These provide for scattered rural communities too small to support separate efficient libraries, and bridge the gap between state and city or town libraries. Instead of setting up an independent library some counties contract with a city public library for service throughout its county. Some county libraries absorb weak local libraries as branches or delivery stations. Though most of these libraries are in the West, California leading, they are spreading rapidly.

People's University.— Support of libraries by fees has largely given way to support by taxation. A fee is prohibitive to many, and communities recognize that it is as much for their interests to have the «people's university» as the public schools free to all. Hours of opening have been lengthened from 2 to 3 a day till the larger libraries usually open from 8 or 9 A.M. to 9 or 10 P.M. and no longer close for evenings, holidays, vacations or annual inventory. Sunday opening, for at least reading and reference, is common in all but the smallest libraries. The modern library is available to readers at any time when they are inclined to use it.

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MELVIL DEWEY.

LIBRARY ARCHITECTURE AND CONSTRUCTION. The problems of library construction have been considered so often during the last few decades that the erection of a faulty library building would appear unnecessary, yet, judging from complaints made by librarians from time to time, some of the buildings erected have failed to respond to all of the demands made upon them. In general this condition appears to have resulted from one or more of the following causes: (1) An effort to erect a monumental building, (2) to conform it to a type of architecture unsuited to library purposes, (3) the appointment, often by competition, of an architect unschooled in the requirements of a library, (4) failure to consult with the librarian or with library experts. Much advancement has undoubtedly been made toward co-operation between architect and librarian, and many good designers have made library buildings their specialty, nevertheless it seems that the ideal type of library is not yet realized — the type so adapted to its purpose that it would be immediately recognized as such, as is the case with school buildings at the present time. This does not mean that library constructions should conform rigidly to a fixed standard of appearance and arrangement, but it does mean that the exterior should express as nearly as possible the purpose and functions of the interior. The body should properly and adequately house the spirit. The modern library building is the product of many years of experimentation and of fruitless efforts to adapt old types to new conditions. This applies with especial force to the one known as the alcove type, which was inherited from the mediæval cloister libraries. This still has many advantages for small libraries and for special collections, but when its principle is applied to large libraries, as was the case with the old Boston Public Library and the Astor, its defects more than outweighed its advantages. Hence as early as 1882 we find the American Library Association protesting against the construction of more buildings according to this plan. To-day the constructional requirements of a library building are comprehended to such an extent that library planning has become a science determined by definite laws. (Tilton, "Scientific Library Planning," *Library Journal*, September 1912). It seems strange, therefore, that library buildings are still being erected that fail to respond to the legitimate demands made upon them.

The fundamental problems of a library are: (1) *Accessibility;* (2) *economical storage of books,* and (3) *their rapid distribution.* With regard to these elements, the well-known designer of libraries, Mr. Cass Gilbert, has this to say: "The first principle of library location and library planning should be *accessibility.* The whole efficiency of a public library depends upon its being accessible to the *public* in point of location, and being accessible in *all* of its parts to the *working force* and to the public parts by the people who are using it. I should like if practicable to have the main rooms of a library on the ground floor so that the public would not have to climb stairways to get to the delivery hall, yet in practice it appears to have been impossible to solve the problem in that way except in small libraries for reasons of space or economy of construction. In planning library buildings I have considered that the direct access of the public to the point of distribution of books is of prime importance and that this point of distribution should be as close as possible to the place where the books are stored. This results then in the entrance leading direct to the delivery hall, the delivery hall being in close connection with the stack room. The open shelf room should also be near to the delivery hall. Special collections may be placed at more remote locations, but those books which are constantly used by the public should be accessible. A type of plan which is suitable for a large city library is obviously not suitable for a small village library. A college or university library, a special research library, or a law library is essentially different from a city library so it is impossible to lay down any standardized plan." In small libraries these questions are not so urgent. Indeed, for such wall cases, alcoves or small stacks all prove equally serviceable, but when the collections attain to 50,000 volumes or more the question of storage and administration becomes acute.

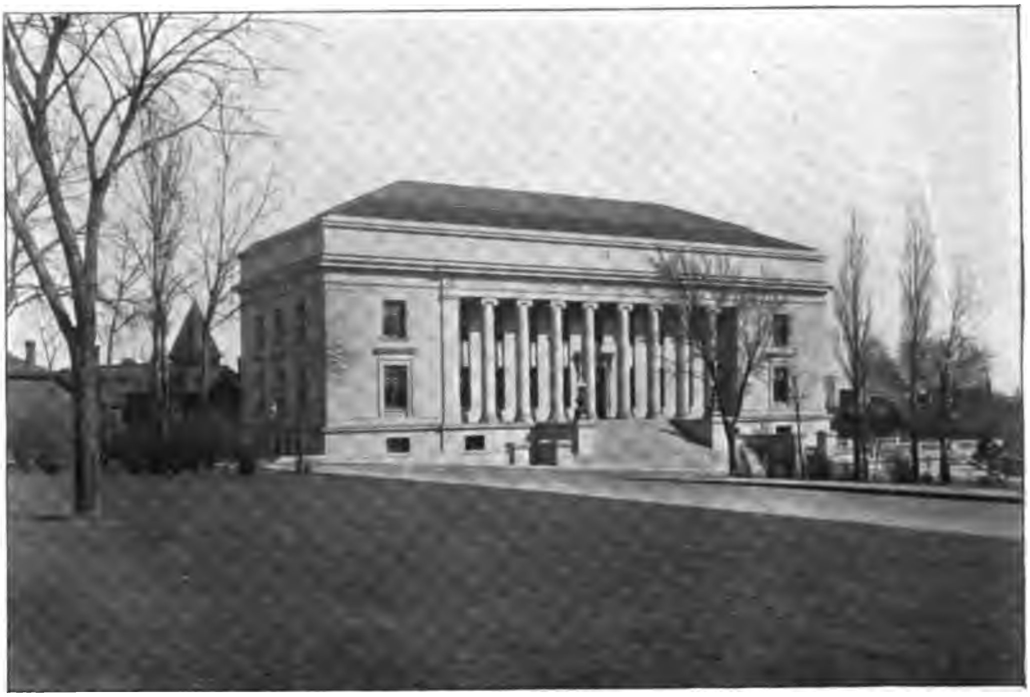
Three elements enter into the construction of any building: (1) *Fitness;* (2) *permanence;* (3) *beauty.* In library construction that is the order of their relative importance. The question of fitness is essentially the concern of the librarian. Here he should be supreme, for unless the architect has a correct knowledge of the problems of library administration he is not competent to decide questions of arrangement, etc., that so intimately affect the operations of the library when it is completed. The architect does not have to work in the building after completion, but the librarian does. This does not, of course, mean that the librarian shall meddle with purely constructional details but it does mean that either he or the trustees should determine the policy or program of construction; the size of the building, its cost, materials, arrangement of rooms, etc., etc. The librarian and the architect should work together, and in order to do so most successfully the sphere of each should be so delimited that no possibility of misunderstanding can arise. In order to attain this happy result, the librarian or building committee should prepare a statement setting forth the characteristics of the proposed building so clearly and fully that the architect can have no excuse for presenting a plan at variance with the proposals. This, in effect, will constitute an order on the architect and its nature will be determined by data pos-

Library of the State Historical Society of Wisconsin, Madison, Wis.

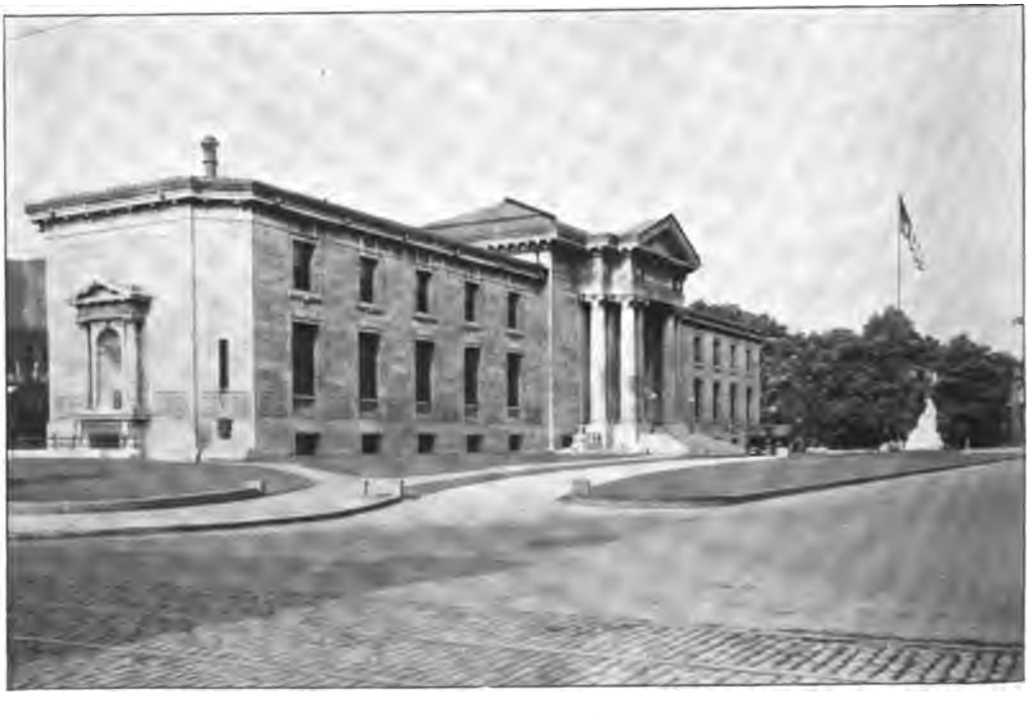
Library of the University of Virginia

Carnegie Library, Atlanta, Ga.

LIBRARIES



Minnesota Historical Society



Louisville Free Public Library

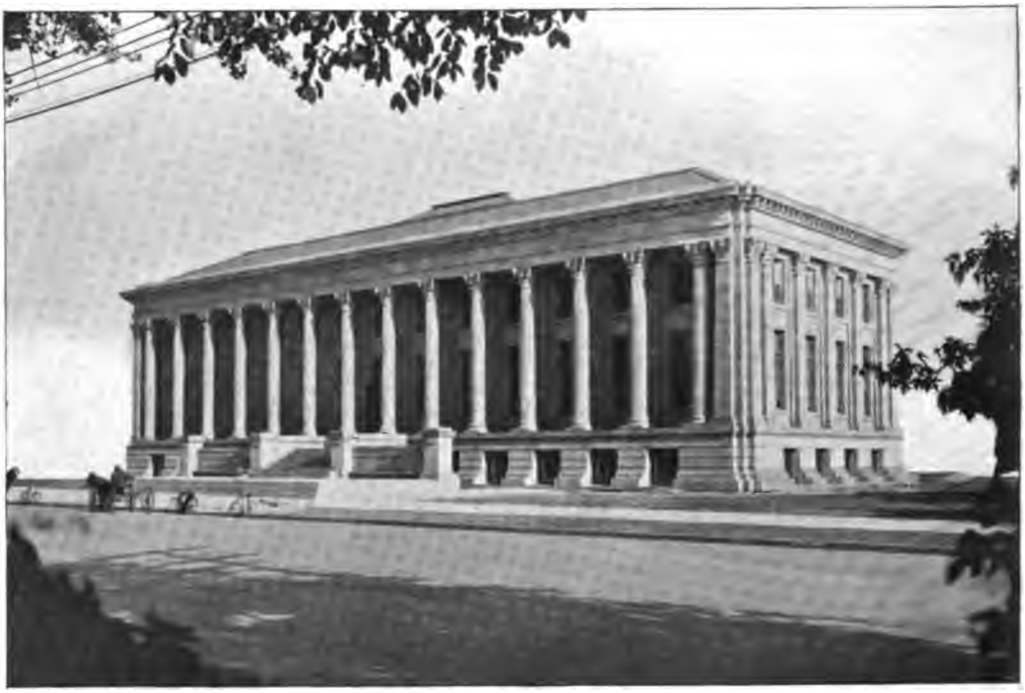
sessed only by the librarian or building committee; i.e., the amount of appropriation, the nature and purpose of the library, the site, etc. The question of permanency is next in order of importance and involves not only the type of material to be used, such as stone, terra-cotta, brick, concrete, etc., but also the problem of providing for future expansion. Failure in the latter respect has been the cause of more distress to librarians than anything else. Apparently a library does not grow by arithmetical progression, but by geometrical, and as soon as an adequate home is constructed it attracts material from undreamed-of sources and in a steadily increasing volume. Hence any estimates of future development are generally much below the mark. A notable example of this was the case of the Library of Congress building. When planned, it was anticipated that it would accommodate the additions for several decades. This proved so mistaken that a new stack providing for a million volumes was under construction some 10 years after the building was first occupied. It is clear, therefore, that the growth of a library cannot be foreseen with any great accuracy. That it will be greater than any apparently liberal estimate may be taken for granted. Building for the future, therefore, does not mean a structure vastly larger than the needs of the present and immediate future, but it does mean that no building shall be erected that cannot be enlarged without injury to its design or without needless expenditures for demolitions and modifications. In short the additions should be considered in the original plans. With this in view, it is evident that a library building should not have ornamental façades on all sides, expensive to construct, and a complete loss if extensions are made. The question of material should be determined by the appropriation, by local conditions, etc. It is needless to say that it should be as nearly fireproof as possible. So-called absolute fireproof construction costs one-third more than a relative fireproof construction and ordinarily the latter will present a sufficient factor of safety. Stone, of course, is favored for the greater library buildings, but is the most expensive type of material. Excellent effects have been attained with much saving by the use of terra-cotta, brick and concrete. Frame construction, on account of its great inflammability, is not desirable, yet it would be better for a community to construct such a building rather than none at all. At least, it will be a nucleus for something better. The element of beauty, as far as it concerns a library, is essentially a by-product. Failure to recognize this point has been the prime cause of unfit library buildings. The designers of the public schools have learned this lesson and now library architects should recognize it universally and thereby avoid experiments and sad mistakes. It is difficult to fix the responsibility for the common error that a library should be something ornate and monumental. Sometimes it is due to the desire of the building committee to supply an architectural wonder to the community; again it may be that the librarian either favors or fails to oppose with sufficient energy an ornate structure. Generally, however, it would appear that the chief sinner is the architect who has seized upon an opportunity to express himself in the grand style. Another fruitful cause of unfit buildings is the predilection of architects for certain styles of architecture. Thus, for instance, the follower of classic traditions will build nothing but Greek temples, although the Greek temple is undoubtedly the very worst thing wherein to house a collection of books; a lover of the Gothic will construct lofty apartments, difficult to heat and expensive to build, ignoring, more or less, the most important element of floor space. The craze for libraries built after the Romanesque pattern, which sprang up owing to the genius of Richardson, certainly resulted in an advance in library construction, but their thick walls and deficient fenestration give them a tomb-like quality thoroughly depressing to the average reader.

To sum up, the æsthetic requirements of a library are satisfied by a construction marked by taste, dignity and repose, with no excess of decoration and ornamentation. In fact, warmth, homelikeness and restfulness are the characteristics that good psychology would recommend for a building dedicated to the conservation and distribution of knowledge. Should these principles be adhered to there can be no doubt that a purely library type of architecture will develop, if it has not already done so. Like the modern skyscraper, the library will find a type of construction all its own, sufficiently lovely and none-the-less a library. To gain this end, only one thing is necessary: to plan libraries from within, for all beautiful buildings became such because first of all they were fit. From the viewpoint of interior efficiency the following are the minimum requirements: (1) *Sufficient floor space;* (2) *compactness;* (3) *light;* (4) *heat and ventilation;* (5) *storage.* 1. *Floor space.* The amount of floor space assigned to the various departments will necessarily depend upon the nature of the library, but taking the public library as the norm, the assignment of floor space would average as follows: Reading-room, delivery-room, etc., 50 per cent; administration, 20 per cent; lecture hall, 10 per cent; stack, 20 per cent. There will of course be variations, particularly with regard to the stacks, which of course expand more rapidly and easily than the other groups. 2. *Compactness.* This is closely related to the preceding requirement, and means that the library be planned for economical administration. What is known in military science as "interior lines of communication" should be adhered to, so that the various processes in handling the book will link up without loss of space or time. Every step that is wasted and every needless operation caused by constructional exigencies stamp the building as faulty to that degree. All portions of the building from the basement to the attic should be available, and waste spaces formed by unnecessary passages and stairways should be avoided. 3. *Light.* The eye is the organ used almost exclusively in a library, hence the illumination should be abundant in quantity and diffused in quality. Therefore any form of construction that decreases light, such as overhanging porticoes, massive walls or dark tones in decoration, are distinctly bad. Direct sunlight and glares are bad, but otherwise there is little danger of too much light. This applies equally to artificial lighting, which should be supplied by electricity where available. Indirect systems of illumination are considered preferable, but they are not economical, and certainly are not recommended for stacks and situations requiring concentration of light. 4. *Heat and Ventilation.* Mental work is most efficiently performed where the temperature is neither too warm nor too cool, 68° to 70° Fahrenheit, and where there is an abundance of fresh air, without drafts. In general the direct-indirect method of heating appears to be the most satisfactory, for by means of it not only is the building heated but it is also supplied with fresh air. Furthermore the space-wasting and unsightly radiators are avoided, air-ducts in convenient positions in the walls or at positions being substituted. There should, of course, be ventilating exits for impure air and, in addition, some libraries use forced or artificial ventilation. Such a system has its advantages, but it is expensive to install and to maintain, and in certain cases has not been wholly a success. It might, however, be used to advantage in the reading-rooms and other assembly halls. The nature of the collections and the uses to which they are put will necessarily have a determining effect upon the type of building demanded. Thus, for instance, a special or associational library will require different arrangements from a public library, and the public library from a university library. For a technical collection, a small reference library or university seminar collection, the alcove system has very decided advantages, which disappear, however, as soon as the collection exceeds, say, the 50,000-mark. These points apply, though with less force, to theological, medical and law libraries. The latter, in particular, requires special treatment, for a law library is a reference library in the strictest sense, not partially but as a whole. The entire collection, sometimes very extensive, should be immediately accessible. In many cases, such as that of the Social Law Library, Boston, the problem has been solved by placing the stacks down one side of a long apartment, the other side of the room being arranged for readers, who have direct access to the books on the shelves. A similar arrangement would be satisfactory for the larger medical, technical and scientific libraries. Theological, historical and document collections, partaking more of the characteristics of general libraries, could make use of stack system. General reference libraries are subject to the conditions determining any library building, yet there are certain differences that require special attention. The university library is perhaps the best type of this class. This has some very special problems that influence the construction of the building. One of these is the necessity for making it conform with the other buildings in the academic group, for more and more the universities are planning all new buildings according to predetermined architectural styles. The necessity for conformity on the part of the library could conceivably result in an unsatisfactory building, unless great care were taken in its design. Another serious problem of the university library is the necessity for providing for the special collections demanded by the different academic departments. In some institutions the university library is little more than a collection of separate special libraries, the general library containing only a minority of the total collections. However, the difficulties of administration and oversight, the danger of losses and changes of position, more than offset the advantages of this system and has led to its general abandonment. A compromise has been adopted either in the nature of a rigid restriction of the books in a department's collection to its particular subject, or by providing seminar or special rooms for the various departments in the central library, where they can be administered by the staff. In some cases there is direct access to the stacks and the main body of the literature from the seminary room. This system, in the main, follows the principles advocated by Dr. Poole and followed out by him in the Newberry Library. Practically all of the university libraries have adopted it, notably Harvard, Johns Hopkins, Chicago, Illinois, Michigan and California. In most cases provision is made for research work in the stacks, table alcoves being installed for the use of professors and advanced students. This policy of course requires the construction of wider aisles along the stack ranges. In general no distinction is made in the reading and reference rooms between the serious student and the casual reader or those who make use of these rooms as study halls between classes. The last group presents a very serious problem in large university libraries and in certain buildings an effort is made to solve it by providing study halls. The constructional problems of a large public library are infinite, but as such a library, owing to its size and the variety of its interests, tends to split up into very distinct departments, these problems can best be solved by considering each department as a unit. By determining its particular needs first, and then defining its relations to other departments and co-ordinating the whole, a satisfactory basis for a plan could be attained. With regard to the site a main public library should be situated as near to the centre of population as possible without establishing it on a traffic artery, with the accompanying inconveniences of noise, dust, etc. The building should be of durable material, preferably stone or brick; and as nearly fireproof as possible. As great public libraries are both reference and circulating libraries the plans should provide for a separation of these activities. This problem has been most admirably solved in the plans of the New York Public Library. It appears to be traditional that a public library should possess a large auditorium. This is more or less of a luxury and as it is only occasionally used it would seem wiser to hire a hall when lectures are offered by the library, rather than carry so much unused space. The suggestions already presented regarding light, ventilation and provision for expansion apply with particular force to the public library. In the larger cities the central library cannot keep in touch with the whole community. For this reason branch library systems have been established. Special buildings have been erected or rooms acquired. The constructional problems of these, however, are those of the small library, the only differences being extreme compactness permitting a small administrative force, absence of cataloguing rooms, etc.; small

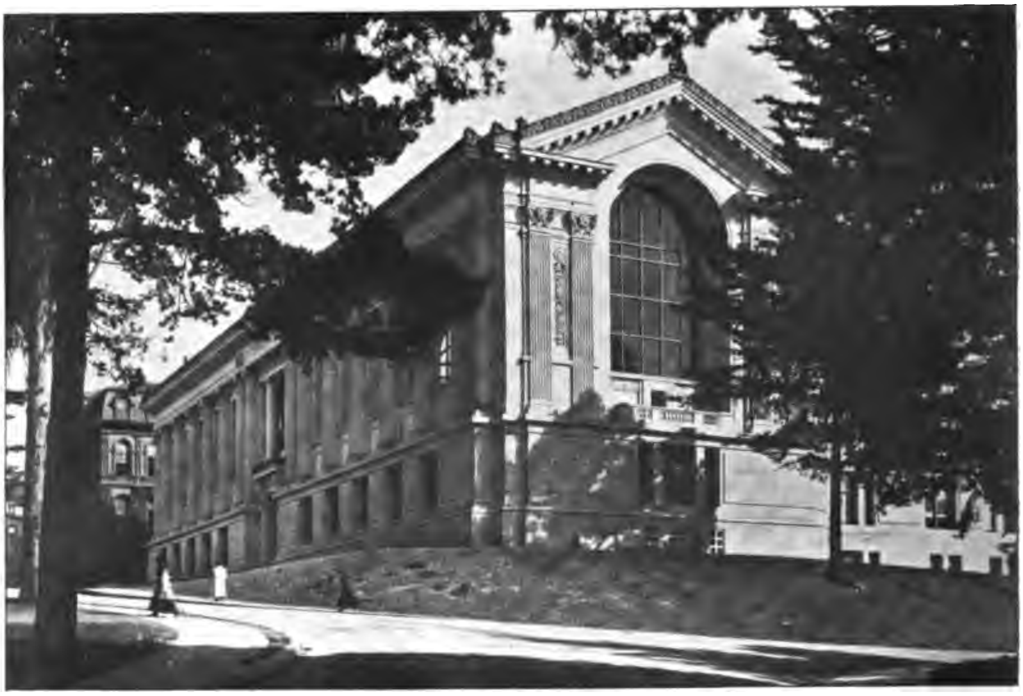
LIBRARIES

1 Harvard College Library, Harvard University
2 General Reading Room, Widener Memorial Library, Harvard University

LIBRARIES



Public Library of the City of Denver, Denver, Col.



Library of the University of California

stacks, preferably open to the public; and provisions for the reception and return of books forwarded by the parent library. The stack question is, of course, a most vital one in library planning, yet it is one that has been fairly well answered by American constructive genius. The modern stack to be found in the libraries of our country constitute a most adequate adaptation of construction to the demands of the situation. There is nothing to compare with it in foreign countries. One step is yet to be taken, which is for the architect to frankly accept the stack and, instead of hiding it away behind screens of walls, often unnecessary, to concern himself with its architectural possibilities. The admirable results obtained in the Denver Public Library and in some smaller library buildings point the way to a new and most interesting field of development in library construction.

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Edwin Wiley,
Librarian, United States Naval War College.

LIBRARY BUILDINGS. See Library Administration; Library Architecture.

LIBRARY OF CONGRESS, The. See Congress, Library of, Washington, D. C.

LIBRARY DATA.* For convenience of ready reference the principal libraries throughout the world are here tabulated by nations:

		Status	Founded	Number of Volumes
Argentina.				
Buenos Aires	Biblioteca Nacional	Reference	1810	300,000
Australia.				
Melbourne	Victoria Public Library	Public	1854	258,756
Sydney	N. S. Wales Public Library	Public	1869	258,742
Austria–Hungary.				
Budapest	Magyar Nemzeti Múzeum	Reference	1802	289,098
Cracow	Universytet Jagiellónski Bibliothek	University	1400	429,355
Graz	Königliche Kaiserliche Universitäts-Bibliothek	University	1586	270,959
Klausenburg	Königliche Universitäts-Bibliothek	University	1872	252,443
Prague	Königliche Kaiserliche Universitäts-Bibliothek	University	1773	380,769
Vienna	Königliche und Kaiserliche Hofbibliothek	Reference	1440	1,000,000
	Königliche und Kaiserliche Universitäts-Bibliothek	University	1775	883,394
Belgium.				
Brussels	Bibliothèque Royale	Reference	1837	700,000
Ghent	Bibliothèque de l'Université	Reference	....	450,000
Liège	Bibliothèque Universitaire	University	1817	300,000
Louvain	Bibliothèque de l'Université Catholique (destroyed by the Germans, 27 Aug. 1914)	University	1627	230,000
Brazil.				
Rio de Janeiro	Bibliotheca Nacional	Reference	1810	330,000
Canada.				
Ottawa	Library of Parliament	Reference	....	400,000
Toronto	Public Library	Public	....	258,000
	University Library	University	....	142,860
China.				
Peking	Imperial Library	Reference	....	100,000
Denmark.				
Copenhagen	Kongelige Bibliothek	Reference	1665	770,000
	Universitets Bibliothek	University	1482	400,000
France.				
Grenoble	Bibliothèque de la Ville	Public	1772	269,024
Lille	Bibliothèque des Facultés Catholiques	University	....	235,000
	Bibliothèque de la Université	University	....	407,000
Lyon	Bibliothèque de la Ville	Public	1527	450,000
Paris	Bibliothèque d'Arsenal	Reference	1797	624,904
	Bibliothèque de l'Institut	Reference	1795	550,000
	Bibliothèque Nationale	Reference	1367	4,050,000
	Bibliothèque de Sainte Geneviève	Reference	1624	400,000
	Bibliothèque de l'Université	Reference	1762	600,000
Germany.				
Bamberg	Königliche Oeffentliche-Bibliothek	Public	1611	350,000
Berlin	Königliche Bibliothek	Reference	1661	1,500,000
	Königliche Universitäts Bibliothek	University	1829	265,856
Bonn	Rheinische,-F. W.-Universitäts-Bibliothek	University	....	376,800
Dresden	Königliche Oeffentliche Bibliothek	Reference	....	570,000
Erlangen	Königliche Universitäts-Bibliothek	University	1743	254,083
Frankfort-a-Main	Stadt-Bibliothek	Public	1668	365,529
Freiburg-i.-B	Universitäts-Bibliothek	University	....	300,000
Giessen	Universitäts-Bibliothek	University	1612	261,747
Göttingen	Universitäts-Bibliothek	University	1736–37	619,162
Halle-a.-d.-S.	Universitäts-Bibliothek	Public	1696	284,970
Hamburg	Stadt-Bibliothek	Public	1529	418,000
Heidelberg	Universitäts-Bibliothek	University	1386	500,000
Jena	Universitäts-Bibliothek	University	1558	270,000
Kiel	Universitäts-Bibliothek	University	1665	309,118
Königsberg	Königliche Universitäts-Bibliothek	University	1534	318,000
Leipzig	Universitäts-Bibliothek	University	1543	610,000
Munich	Königliche Hof-u.-Staatsbibilothek	Reference	1550–78	1,190,000
	Königliche Universitäts-Bibliothek	University	1472	691,475

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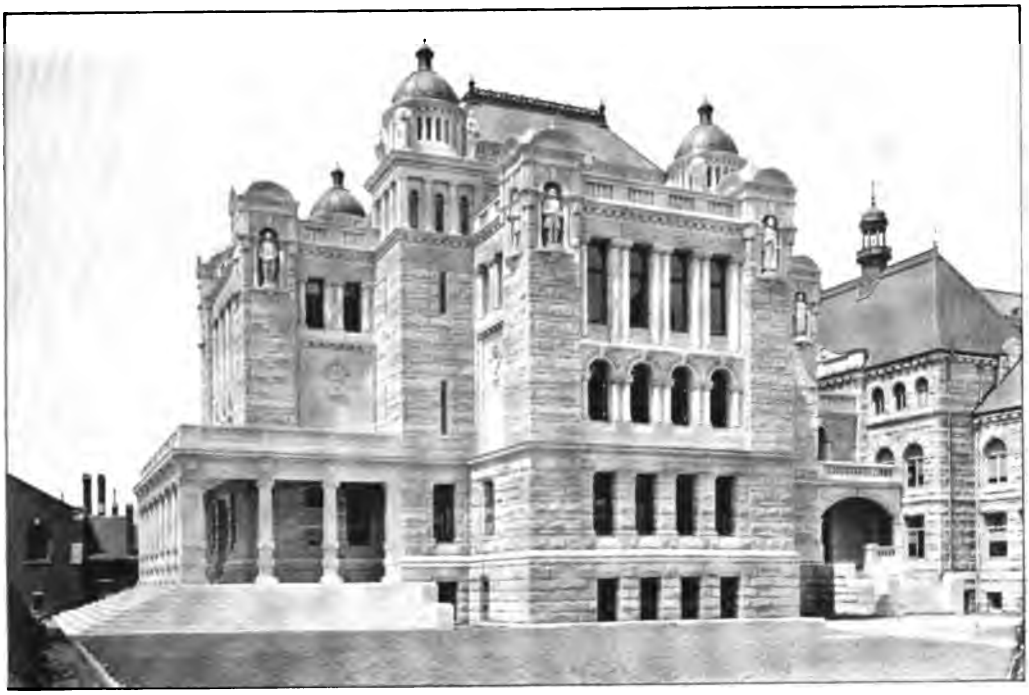
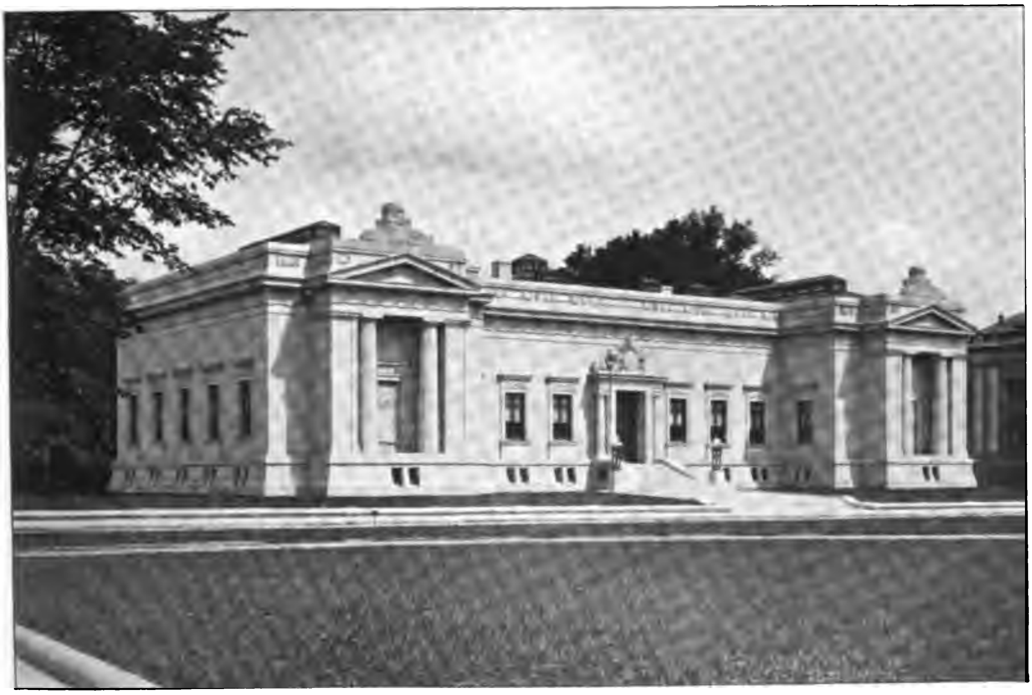
* Obtained from the latest reliable sources, ‘The American Library Annual–1915–1918’ in particular. Through the kindness of Mr. Bowker and Miss Huxley of *The Library Journal*, it has been possible to bring the figures relative to many American libraries quite up to date; in other cases, however, only approximations are presented. This is especially true of the foreign collections.

LIBRARY DATA — Continued

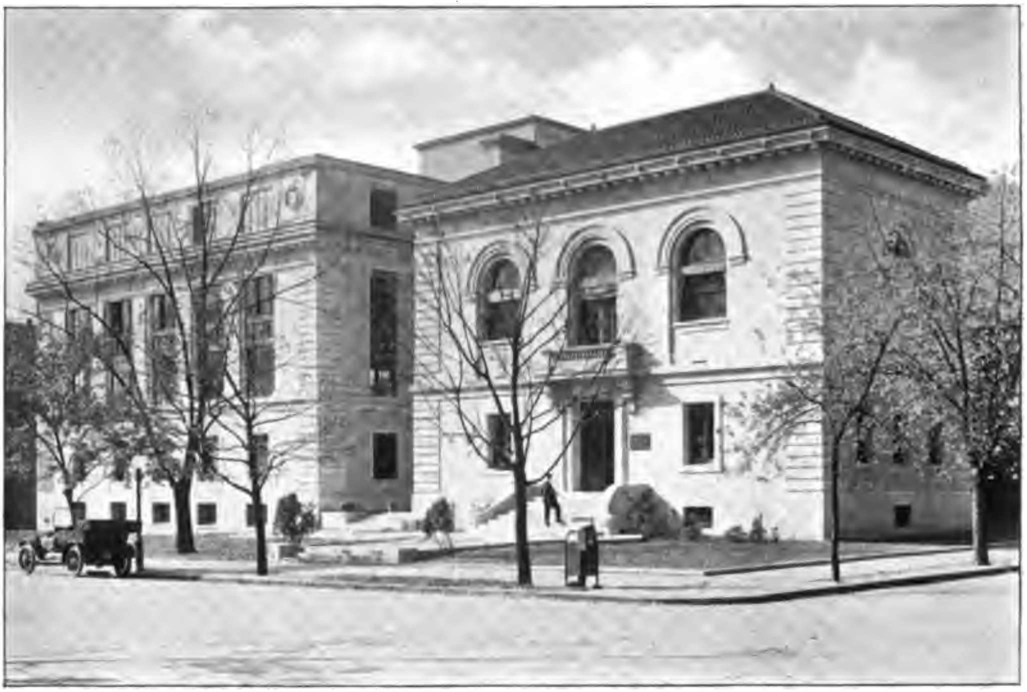
		Status	Founded	Number of Volumes
GERMANY — continued				
Rostock	Universitäts-Bibliothek	University	....	294,000
Strassburg	Kaiserliche Universitäts-Bibliothek	University	1870	1,023,133
Stuttgart	Königliche Landes-Bibliothek	Public	1765	603,186
Tübingen	Königliche Universitäts-Bibliothek	University	1477	555,283
Weimar	Grossherzogliche Bibliothek	Reference	....	300,000
Wolfenbüttel	Herzogliche Bibliothek	Reference	1568–1644	300,000
GREAT BRITAIN.				
Birmingham	Free Libraries	Public	1861	445,675
Cambridge	University Library	University	1444	860,000
Edinburgh	Advocates Library	Reference	1682	632,000
	University Library	University	1583	270,000
Glasgow	Corporation Library	Public	1877	430,000
Leeds	Central Public Free Library	Public	1870	327,210
Liverpool	Public Libraries	Public	1850	338,796
London	British Museum	Reference	1753	3,000,000
	London Library	Public	1841	260,000
	Public Libraries (13)	Public	......	1,125,270
	University College Library	University	1829	150,000
	University of London	University	1839	100,000
	Victoria and Albert Museum	Reference	1837	125,000
Manchester	John Rylands Library	Public	1899	200,000
	Public Free Libraries	Public	1852	500,000
Oxford	Bodleian. Oxford University	University	1598	800,000
GREECE.				
Athens	National Library	Reference	1842	314,000
HOLLAND.				
Amsterdam	Universiteits-Bibliothek	University	1600	600,000
The Hague	Koninklijke Bibliothek	Reference	1798	600,000
Leyden	Rijks-Universiteit Bibliothek	University	1575	400,000
Utrecht	Rijks-Universiteit Bibliothek	University	1584	397,000
ITALY.				
Bologna	Biblioteca Comunale	Public	1801	313,133
	Biblioteca Universitaria	University	1605	255,000
Florence	Biblioteca Archivo di Stato	Documents	1852	566,000
	Biblioteca Marucelliana	Reference	1703	200,000
	Regale Biblioteca Nazionale Centrale	Reference	1714	595,592
	Biblioteca Scientifico	Reference	....	400,000
Milan	Biblioteca Ambrosiana	Reference	1609	230,000
	Biblioteca Nazionale (Braidense)	Reference	1770	259,680
Naples	Biblioteca Archivo di Stato	Documents	1818	1,378,000
	Regale Biblioteca Nazionale	Reference	1734	395,439
	Regale Biblioteca Universitaria	University	1812	353,620
Padua	Regale Biblioteca Universitaria	University	1629	297,359
Parma	Regale Biblioteca Palatina	Reference	1769	313,323
Pavia	Biblioteca Universitaria	University	1778–82	250,000
Rome	Biblioteca Apostolica Vaticana	Reference	1750	350,000
	Biblioteca Nazionale Centrale Vittorio Emanuele	Public	1875	450,000
Turin	Biblioteca Nazionale Universitaria	University	1720	350,000
Venice	Biblioteca Nazionale Marciana	Reference	1468	426,819
Vicenza	Biblioteca Comunale Bertoliana	Public	1708	240,000
JAPAN.				
Kioto	Imperial University Library	University	....	291,117
Tokio	Imperial Cabinet Library	Reference	1885	507,500
	Imperial Library	Reference	1872	298,663
	University Library	University	1872	491,082
NORWAY.				
Christiania	Universitet Bibliothek	University	1811	495,000
PORTUGAL.				
Lisbon	Bibliotheca Nacional	Reference	1796	400,000
RUSSIA.				
Helsingfors	Universitet Bibliothek	University	1640–1827	400,000
Kazan	Universitet Bibliothek	University	1903	309,936
Kief	Vladima Universitet Bibliothek	University	1832	500,000
Moscow	Duchovnaja Akademia Bibliothek	Reference	1689	240,000
	Pub. i Rumantzovski Musei	Reference	1828	1,000,000
	Rossyski Istoriceski Musei	Reference	1875–83	300,000
	Universitet Bibliothek	University	1756	394,845
Odessa	Novorossijski Universitet	University	1865	280,144
Petrograd	Academija Nank	Reference	1728	500,000
	Imperial Public Library	Reference	1814	2,615,374
	Universitet Bibliothek	University	....	453,772
Warsaw	Library of the Polish Kingdom	Reference	....	1,749,837
	Varsavski Universitet Bibliothek	University	1817	576,387
SPAIN.				
Madrid	Biblioteca Nacional	Reference	....	650,000
	Biblioteca de la Universidad Central	University	1508–1836	267,000
SWEDEN.				
Lund	Universitets-Bibliothek	University	1668	200,000
Stockholm	Kungliga Bibliothek	Reference	1585	400,000
Upsala	Kungl. Universitets-Bibliothek	University	1620	400,000
SWITZERLAND.				
Basel	Oeffentliche Bibliothek	Public	1460	330,094
Berne	Bibliothèque Nationale Suisse	Reference	1895	225,000
Geneva	B. Publique et Universitaire	Reference	1560	200,000
	Stadt-Bibliothek	Public	1528	225,000
Lausanne	Bibliothek Cantonale	Public	....	300,000
Zürich	Stadt-Bibliothek	Public	1629	257,599



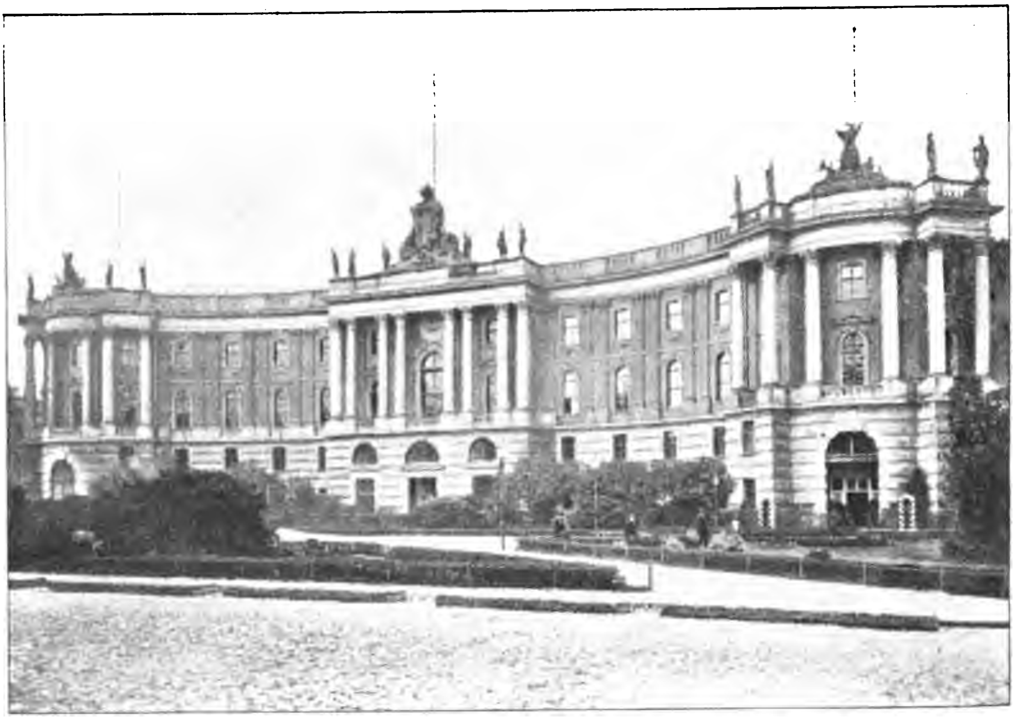
Provincial Library, Victoria, British Columbia



New Hampshire Historical Society, Concord, N. H.



The Home of the National Geographic Society. On the right is the Gardiner Greene Hubbard Hall, erected for the Society by the heirs of its first president. In this building are the Board rooms and Library. The administration building adjoining is devoted to the editorial and business offices of the Magazine



The National Library, Berlin

LIBRARY DATA — Continued

		Status	Founded	Number of Volumes
UNITED STATES.				
Albany, N. Y.	New York State Library	Reference	1818	449,542
Ann Arbor, Mich.	University of Michigan Library	University	1841	383,976
Baltimore, Md.	Enoch Pratt Free Library	Public	1882	355,817
	Johns Hopkins University Library	University	1876	202,247
	Peabody Institute Library	Reference	1857	197,634
Berkeley, Cal.	University of California Library	University	1869	355,192
Boston, Mass.	American Academy of Arts and Science	Scientific	1780	34,287
	Boston Athenæum	Reference	1807	264,531
	Boston Medical Library	Medical	1875	85,963
	City Free Library	Public	1848	1,157,326
	Congregational Library	Theological	1853	64,561
	Massachusetts Historical Society	History	1791	58,502
	Massachusetts Institute of Technology	Technological	1889	121,711
	New England Historical and Genealogical Society	History	1844	39,711
	Social Law Library	Law	1803	65,000
	State Library	Law	1826	192,051
Brooklyn, N. Y.	Public Library	Public	1896	862,112
Buffalo, N. Y.	Public Library	Public	1836	363,546
Cambridge, Mass.	Harvard University, Andover–Harvard Theological Library	Theological	1817	106,771
	Harvard University, Arnold Arboretum Library	Forestry	....	31,213
	Harvard Astronomy, Observatory Library	Astronomical	1848	14,986
	Harvard College Library	University	1638	792,117
	Harvard Gray Herbarium	Botanical	1864	17,525
	Harvard Law School	Law	1817	172,073
	Harvard Museum of Comparative Zoology	Scientific	1859	54,683
	Harvard Peabody Museum	Ethnological	....	7,119
Chicago, Ill.	Chicago Historical Society	History	1856	24,738
	John Crerar Library	Scientific	1904	384,603
	Municipal Reference Library	Economics	1900	15,957
	Newberry Library	Reference	1887	375,182
	Public Library	Public	1871	806,172
	University of Chicago	University	1892	517,936
Cincinnati, Ohio	Public Library	Public	1828	515,906
Cleveland, Ohio	Public Library	Public	1868	584,340
Columbus, Ohio	State Library	Legislative	1817	213,723
Detroit, Mich.	Public Library	Public	1865	450,910
Denver, Colo.	Public Library	Public	1884	192,366
Harrisburg, Pa.	State Library	Legislative	1816	176,624
Hartford, Conn.	State Library	Legislative	1854	200,000
Ithaca, N. Y.	Cornell University Library	University	1868	489,656
Kansas City, Mo.	Public Library	Public	1876	271,077
Los Angeles, Cal.	Public Library	Public	1872	309,163
Madison, Wis.	University of Wisconsin Library	University	1850	255,000
	Wisconsin Historical Society	History	1849	376,000
	Wisconsin State Library	Law	1836	58,000
Milwaukee, Wis.	Public Library	Public	1875	342,194
Minneapolis, Minn.	Public Library	Public	1885	334,763
	University of Minnesota	University	1867	251,000
New Haven, Conn.	Yale University Library	University	1700	1,025,000
New York, N. Y.	American Geographical Society Library	Geographical	1852	45,000
	Association of the Bar	Law	1870	114,437
	Columbia University Law Library	Law	....	59,262
	Columbia University Library	University	1754	630,075
	Columbia University Teacher's College	Education	1887	60,500
	Engineering Societies	Engineering	....	62,446
	Mercantile Library	Public	1820	246,817
	Metropolitan Museum	Art	1879	29,000
	New York Academy of Medicine	Medicine	1847	101,593
	New York Historical Society	History	1804	130,866
	New York Law Institute Library	Law	1828	81,209
	New York Society Library	Society	1754	100,000
	Free Public Library	Public	1854	2,538,000
	Russell Sage Foundation	Sociological	1893	15,695
	Union Theological Library	Theological	1836	133,944
Newark, N. J.	Free Public Library	Public	1847	256,581
	Prudential Life Insurance Company	Insurance	1893	100,000
Philadelphia, Pa.	Academy of Natural Sciences	Scientific	1812	80,000
	Franklin Institute	Scientific	1824	71,000
	Free Library	Public	1731	534,152
	Historical Society of Pennsylvania	History	1824	202,000
	Library Company of Philadelphia	Public	1731	249,209
	Library of the College of Physicians and Surgeons	Medicine	1789	107,782
	Philadelphia Commercial Museum	Commercial	....	37,314
	University of Pennsylvania Library	University	1755	413,519
Pittsburgh, Pa.	Carnegie Library	Public	1890	434,469
Portland, Ore.	Library Association	Public	1864	266,729
Princeton, N. J.	Princeton University Library	University	1746	397,427
Providence, R. I.	Brown University Library	University	1768	240,000
	Public Library	Public	1878	181,307
	Rhode Island State Library	Legislative	....	40,144
Sacramento, Cal.	California State Library	Legislative	1850	207,283
Saint Louis, Mo.	Christian Brothers College Library	University	1860	273,842
	Public Library	Public	1865	487,336
Salem, Ore.	Oregon State Library	Legislative	1851	136,986
San Francisco, Cal.	Public Library	Public	1878	191,960
	Mechanics Mercantile Library	Reference	1854	127,866
Stanford, Cal.	Leland Stanford University Library	University	1891	287,634
Urbana, Ill.	University of Illinois Library	University	1868	388,000
Washington, D. C.	Bureau of Railway Economics	Railways	1910	50,000
	District of Columbia Public Library	Public	1898	200,000

LIBRARY DATA — Concluded

		Status	Founded	Number of Volumes
UNITED STATES — con.				
Washington, D. C.	Georgetown University Library	University	1791	104,785
	Law Library of Congress	Law		168,719
	Library of Congress	Reference	1800	2,451,974
	Library of the Surgeon-General's Office	Medical	1865	190,310
	Pan-American Union	History	1890	32,834
	Public Documents Library	Documents	1895	193,533
	Smithsonian Institution	Scientific	1846	521,616
	Supreme Council Thirty-third Degree (Masonic)	Masonry	1886	75,000
	United States Army War College	Military	1885	100,000
	United States Bureau of Education	Education	1868	150,000
	United States Bureau of Ethnology	Ethnological		20,430
	United States Bureau of Fisheries	Fisheries		29,155
	United States Bureau of Labor Statistics	Economic		30,282
	United States Bureau of Mines	Mining	1911	12,000
	United States Bureau of Standards	Scientific	1901	13,621
	United States Coast and Geodetic Survey	Scientific	1832	25,000
	United States Department of Agriculture	Agriculture	1868	131,693
	United States Department of Commerce	Commerce	1866	54,540
	United States Department of Justice	Law	1831	45,000
	United States Department of the Navy	Naval	1882	50,000
	United States Department of State	Diplomatic	1789	73,000
	United States Engineers' School	Military		45,115
	United States Forest Service	Forestry		12,245
	United States Interstate Commerce Commission	Railways		13,000
	United States Geological Survey	Geological	1882	120,000
	United States House of Representatives	Documents		275,000
	United States National Museum	Scientific		43,692
	United States Patent Office	Technical	1836	93,300
	United States Senate Library	Law	1852	200,000
	United States Treasury Department	Finance		11,060
	United States Weather Bureau	Meteorological	1870	34,000
	Volta Bureau	Deaf		9,000
Worcester, Mass.	American Antiquarian Society	History	1812	140,000
	Public Library	Public	1859	224,482

LIBRARY LAWS AND LEGISLATION IN THE UNITED STATES. As in the case of education, each State has complete control of the library situation within its boundaries. In many States the libraries have received great assistance and encouragement from the State administration; in many others, on the contrary, they have been neglected and sometimes discouraged. State library legislation has concerned itself mainly with the following topics: (1) Founding of libraries; (2) their administration and supervision by library commissions, etc.; (3) development of school libraries; (4) of country and rural libraries; (5) of traveling libraries. Legislative reference bureaus and provision for popular lectures and for educational extension by means of the library are more or less liberally provided for by certain States.

1. The laws regarding the foundation of libraries are universally permissive and not mandatory. That is, a community is empowered to vote an appropriation for the establishment and support of a public library. The method of obtaining the endowment differs in different States, the usual one, however, being the addition of a small percentage (one-half to five mills on the dollar) to the tax rate. In other cases a popular subscription up to a certain amount is authorized, which, in a very few cases, is supplemented by an additional fund from the State treasury. Virtually all of the States have library enabling or foundation acts in some form or other.

2. Less unanimity is discoverable regarding the laws for administration and supervision, 11 of the States having no legislation on that subject. It is not surprising furthermore to find that these States are the ones in which library facilities are least developed. In those States which have enacted laws on this subject there is considerable difference of method in obtaining the desired end. In general, however, a State library commission is provided for, which has oversight and direction of the libraries. In the case of California and of Virginia, the State library has the functions of a library commission, while in New York, Rhode Island, Tennessee and Utah, the State Board of Education has control, acting through special commissions or representatives. In Alabama the State Department of Archives and History has the function of a library commission. Colorado provides for two library commissions, one of which has direction of the traveling libraries.

The following States have laws providing for a library commission or some other form of direction and control: Alabama, Arkansas, California, Colorado, Connecticut, Delaware, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin (37).

3. The following States make provision in their laws for school libraries: Alabama, Arizona, California, Colorado, Connecticut, Delaware, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, Wyoming (43).

4. The following States have laws providing for the extension of library facilities to

counties and rural districts: California, Delaware, Indiana, Iowa, Maryland, Minnesota, Missouri, Montana, Nebraska, New York, Ohio, Oregon, Texas, Virginia, Washington, Wisconsin, Wyoming (17).

5. Traveling libraries are provided for in Iowa, Kansas, Kentucky, Maryland, Minnesota, New York, North Carolina, North Dakota, Vermont, Virginia and Wisconsin (11); and legislative reference bureaus in Alabama, Georgia, Illinois, Indiana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Texas and Wisconsin (13). Pensions for library employees are provided for in Illinois and Nebraska (2) and Kansas provides for libraries in penitentiaries.

EDWIN WILEY,
Librarian, United States Naval War College.

LIBRARY PERIODICALS. The special publications devoted to library work throughout the world will be found detailed by nations in the following list:

United States.—*American Library Annual* (New York 1911–); *American Library Association. Bulletin* (Chicago 1907–); *American Library Association. Proceedings* (Chicago); *Bibliographical Society of America. Papers* (Chicago 1906–); *Library Journal* (New York 1876–); *Public Libraries* (Chicago 1896–); *Special Libraries* (Boston 1910–).

Austria-Hungary.— *Oesterreichische Zeitschrift für Bibliothekswesen* (1897–); *Zeitschrift des Österreichischen Vereins für Bibliothekswesen* (Vienna 1910–).

Belgium.— *Bulletin de l'Institut International de Bibliographie* (Brussels 1895–); *Revue des Bibliothèques et Archives de Belgique* (Brussels 1903–).

Denmark.— *Bogsamlingsbladet* (Copenhagen 1906–).

France.— *Bulletin de l'Association des Bibliothècaires Français* (1907–); *Bulletin du Bibliophile et Bibliothècaire* (1834–); *Bulletin des Bibliothèques Populaires* (Paris 1906–); *Courrier des Bibliothèques* (Paris); *Revue des Bibliothèques* (Paris 1891–).

German Empire.— *Bibliothekar* (Leipzig 1909–); *Blätter fur Volksbibliotheken u. Lesehallen* (Leipzig 1900–); *Jahrbuch der Deutschen Bibliotheken* (Leipzig 1902–); *Zentralblatt fur Bibliothekswesen* (Leipzig 1884–).

Great Britain.— *Librarian and Book World* (1910–); *Library* (1884–); *Library Assistant* (1898–); *Library Association Record* (1899–); *Library World* (London 1898–).

Holland.— *De Bibliothecaris* (Rotterdam 1912–); *De Boekzaal* (The Hague 1907–); *Het Boek* (The Hague 1912–); *Maandblad voor Bibliothekwesen* (The Hague 1913–).

India.— *Library Miscellany* (Baroda 1913–).

Italy.— *Bolletino della Civica Biblioteca e del Museo; Bollettino delle Biblioteche Popolari* (Milano 1907–); *Revista della Biblioteche e degli Archivi* (Florence 1890–).

Norway.— *For Folkeoplysning* (Christiania 1907–); *Nordisk Tidskrift för Bok-och Biblioteksväsen* (Upsala 1914–).

Russia.— *Le Bibliothécaire* (Saint Petersburg 1910–).

Spain.— *Revista de Archivos, Bibliotecas y Museos* (Madrid 1897).

Sweden.— *Bibliotheks Bladet* (Stockholm 1916–); *Folke Bibliotheks Bladet* (Stockholm 1903–).

LIBRARY SCHOOLS. See LIBRARY TRAINING.

LIBRARY TRAINING. M. W. Schrettinger, in his 'Versuch eines vollständigen Lehrbuchs der Bibliotheks-wissenschaft' (Munich 1829) was probably first to suggest special schools for training librarians. F. Rullman, librarian of the University of Freiburg, in 1874 outlined a university course in library science. The older libraries and librarians were intensely individualistic, and these, as well as other early schemes, emphasized the bibliographical side rather than the administrative. Recognition of librarianship as a profession and the consequent professional co-operation of librarians were necessary for substantial progress in library training. The first really constructive work in this direction followed the formation of the American Library Association in 1876. A regular course in bibliography was established at the University of Michigan in 1882 and a chair of library science at Göttingen under Karl Dziatzko, in 1886.

The beginning of systematic library training in America is largely due to Melvil Dewey, who on 5 Jan. 1887 opened the School of Library Economy at Columbia College, New York City. This was transferred to Albany in 1889 and renamed the New York State Library School. From this pioneer school five types of library training agencies have developed: library schools; apprentice and training courses; short courses; library courses in schools and colleges and miscellaneous agencies.

Library Schools.— Regular library schools give courses of either one or two school years. All are connected with libraries which are used for study and practice. The location of the school usually determines whether public, college or reference library work is emphasized. The principal subjects are substantially the same in the different schools. They include bibliography, reference work, selection and evaluation of books, history of books and libraries, binding, cataloging, classification, library administration, library buildings and many other technical and social aspects of library work, sometimes grouped under the term "library economy." Practice in varied library work is required. Entrance requirements range from high school graduation to college degree.

The Association of American Library Schools was formed at Albany, N. Y., 29–30 June 1915, for the improvement of library school training. Membership is limited to schools giving at least one full year of library training and meeting the minimum standards of equipment, faculty personnel and curriculum prescribed by the association. The present members of the association (1919), with date of founding, length of course and degrees granted are:

1887. New York State Library School, Albany, N. Y. (2 years. College graduates only. Bachelor of Library Science. Master of Library Science.)
1890. Pratt Institute School of Library Science, Brooklyn, N. Y. (1 year.)
1893. University of Illinois Library School, Urbana, Ill. (2 years. College graduates only. Bachelor of Library Science.)
1897. Syracuse University Library School, Syracuse, N. Y, (2 years. Bachelor of Library Economy.)

1900. Carnegie Library School, Pittsburgh, Pa. (3 courses of 1 year each.)
1902. Simmons College. School of Library Science, Boston, Mass. (1 year. Bachelor of Science.)
1904. Library School of Western Reserve University, Cleveland, Ohio. (1 year.)
1905. Library School of the Carnegie Library of Atlanta, Ga. (1 year.)
1906. Library School of the University of Wisconsin, Madison, Wis. (1 year.)
1911. Library School of the New York Public Library, New York City. (1 year and advanced electives.)
1914. Los Angeles Public Library Training School, Los Angeles, Cal. (1 year.)

Other library schools giving a one-year course are the California State Library School, Sacramento, Cal.; Saint Louis Public Library School, Saint Louis, Mo.; University of Washington Library School, Seattle, Wash., and the Riverside Library Service School, Riverside, Cal. (33 weeks).

Apprentice and Training Classes.— Before the establishment of library schools, service as an apprentice was the usual method of library training. Most large library systems now conduct elementary classes for training assistants for their own libraries. The instruction is usually local in emphasis and chiefly concerned with administrative details. Training classes vary greatly in length, subjects treated and methods of instruction.

Short Courses.— These are elementary courses of three or more weeks' duration, usually given in the summer months and chiefly intended to aid librarians in small public or school libraries or in subordinate positions in large libraries. They are rather numerous and, without any generally accepted standard. They fall, for the most part, into one of four classes: (1) Those conducted independently by State library commissions as in Indiana, Michigan, Minnesota, New Jersey and Pennsylvania; (2) those given by library schools, with or without the co-operation of library commissions, e.g., the summer course of the New York State, University of Illinois, Simmons College and University of Wisconsin library schools; (3) those given as summer courses by colleges, universities and normal schools as at the universities of California, Iowa, Michigan and Missouri and at Columbia University; (4) the independent short course, represented by the Chautauqua (N. Y.) School for librarians.

School, College and University Courses. —These, unlike the «short courses,» are usually a part of the regular curriculum. Secondary and normal school courses usually emphasize the reference use of books, the wider reading of good books and the intelligent use of libraries. Many normal school courses include the elements of library organization and management, especially of school libraries. These courses, which are increasing in number, vary widely in scope and value. College and university courses vary from courses similar to those given by normal schools or apprentice classes for student assistants, to advanced work in bibliography or library technique.

Miscellaneous Agencies.— Many library commissions conduct local library conferences or «institutes» of from one day to two weeks' duration. The American Library Association and many State and local library associations regularly hold meetings for professional discussion. These meetings are important auxiliary forces in promoting professional spirit and encouraging library training. Several States employ library organizers who give personal instruction in library matters to librarians whose libraries they inspect or organize. Correspondence and extension courses in library work have so far made little material progress. The near future will probably see important developments in both directions.

Library Training Outside the United States.—As early as 1877, Italy had prescribed examinations for library positions but, as a whole, libraries outside the United States still depend chiefly on the apprentice system to recruit their staffs. Most of the training given is primarily bibliographical. Extended service and rigid examinations are required in Prussia and Bavaria, and schools for women librarians are maintained in Berlin and Leipzig.

In England, regular extension courses in library subjects, with prescribed examinations, are held under the auspices of the Library Association, chiefly to provide assistants for the public libraries.

In Canada, summer courses have been held at McGill University, Montreal. A nine weeks course is regularly conducted by the Ontario Department at Toronto.

The number of Scandinavian librarians trained in American library schools is steadily increasing. Norway has elementary library courses, in the interest of the rural libraries, in most of her normal schools, and several general library summer courses have been held.

Successful library courses, modeled on American lines, were conducted by Mme. Haffkin-Hamburger, at Shaniawsky University, Moscow, 1913–17. In India two library courses have been established: at Baroda by W. A. Borden and at the University of Lahore by A. D. Dickinson.

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LIBRATION, *in astronomy,* an apparent oscillatory motion of the moon which causes parts near the edge to appear and disappear from time to time. It is threefold in character and was first recorded by Galileo who noted the longitudinal and diurnal libration, while the latitudinal libration was demonstrated by Johann Hevelius, the German astronomer, in the 17th century. The longitudinal libration is due to the moon's rotation in her orbit being irregular from our viewpoint, so that two small strips or gores from pole to pole are visible alternately in the east and west sides, increasing the area we can see. The latitudinal libration arises from the moon's axis being at a slight angle from the perpendicular of its orbit, so that at times we see more of the north polar and at other times more of the south polar region. The diurnal libration is very minute, arising from the altered position of an observer on the rotating surface of the earth. The result of all the apparent eccentricities of movement is that there falls under human observation almost 60 per cent of the lunar surface instead of the half we would see if only one surface was continually toward us.

LIBRI CAROLINI. See Caroline Books.

LIBRI-CARRUCCI DELLA SOMMAIA, Guillaume Brutus Icile Timoléon, gē-yōm broo-tüs ē-sēl tē-mō-lā-ōṅ lē'brē kä-roo'chē děl'lä sŏm-mä'yä, Count, French mathematician: b. Florence, Italy, 2 Jan. 1803; d. near Fiesole, Italy, 28 Sept. 1869. His father was an Italian adventurer, in 1816 condemned at Lyons to 10 years' imprisonment at hard labor and to branding for counterfeiting goods, and who finally became a secret agent of the king of the Netherlands. The son became professor at the University of Pisa, where he published in the scientific journals several articles on the theory of numbers, on analysis and the resolution of indeterminate equations of the first degree. Having been compromised by his political views, he fled in 1830 to France, where the friendship of Arago introduced him to the world of science. Naturalized in 1833 as a Frenchman, he was called to the Academy of Sciences as successor of Legendre. He became inspector-general of public instruction, obtained the cross of the Legion of Honor and was appointed inspector-general of the libraries of France, an office created expressly for him. Several works published by him during this period gave him a widely extended reputation. Among these were 'Histoire des Sciences Mathématiques en Italie depuis la Renaissance jusqu'à la fin du 17e siècle' (1838–41); 'Souvenirs de la jeunesse de Napoléon' (1842); and 'Lettres sur de clergé et la liberté de l'enseignement' (1844). During the latter part of the reign of Louis Philippe, he was suspected of having made use of his office of inspector-general of libraries to plunder them extensively. After the minutest investigation, Libri, who had escaped to London, was found guilty and condemned in June 1850 to 10 years' imprisonment and degradation from public employment. A remarkable paper was written on his behalf by Paul Mérimée entitled, 'Le procès Libri,' and published in 1852 in the *Revue des Deux Mondes*.

LIBURNIA, lī-bėr'nĭ-ạ, in ancient geography, a district of Illyricum along the coast of the Adriatic, now included partly in Croatia and partly in Dalmatia. The country is mountainous and the inhabitants were celebrated from early times as sailors. They occupied the northern islands of the Adriatic and had settlements on the Italian coast. Their chief towns were Scardona and Iader.

LIBYA, lĭb'ĭ-ạ, the geographical term of the ancients for Africa. At first it had mythical boundaries. Though Herodotus seems to have known that Africa was a peninsula, the moderns knew little about this till the Portuguese doubled the Cape of Good Hope in 1497. Homer and Hesiod comprised under Libya all the territory west of Middle and Lower Egypt. Macedonian kings of Egypt, on the development of commerce, necessarily acquired a more exact knowledge, and the wars of Rome with Carthage first gave men accurate knowledge of the interior. The sandy tract in which the Sahara is included was called the Libyan Desert, and that portion of the Mediterranean extending between the coast of Africa and Crete was known as the Libyan Sea. See Africa.

LICENSE, *in law,* permission by proper authority, as to enter upon land, sell liquor, etc.; also, the written or printed document giving such authority. Among the most important of private licenses are licenses to enter land, licenses to make or sell patented articles and licenses granting the sole right to print or to sell certain books. Among the most important of public licenses are those given by municipalities or other governmental authority to persons pursuing certain callings, trades, professions or the like, as for sale of liquor, the practice of medicine, driving of public vehicles, peddling of goods, etc.

A license to enter land vests no estate in the licensee, and the death of either party revokes the license. A license of this kind may be for a consideration or purely gratuitous, but in either case it may be revoked at any time by the licensor. However, if the licensee has paid a consideration for the license and it is revoked by the licensor in such a way as to amount to a breach of contract, the licensee can sue, if there is no fault on his part, for damages for breach of contract. If the licensee refuses to leave after his license has been revoked, he ordinarily becomes a trespasser, whether the time agreed upon has expired or not. Occasionally courts of law and more frequently courts of equity modify this doctrine. A license to enter land, being personal, is not assignable, and it is revoked if the licensor conveys the premises to a third party. A licensee who has been granted exclusive use to land by the owner cannot bring an action against a third party who uses the same land. Similarly, the licensee of a copyright cannot bring an action against one who infringes the copyright. The same rule applies to patents.

Licenses to sell intoxicating liquor and licenses regulating certain callings, as peddling of goods, are usually regulated by State statutes or municipal ordinances, and a fixed fee therefor is generally charged. Usually a high fee is charged for a license to sell intoxicating liquor, either for the purpose of raising revenue or to restrict its sale, or both. This restriction is justified on the ground of public policy, as experience shows that a low license fee favors an increase in the number of places where intoxicating liquor is sold, which in turn leads to an increase in the amount of intoxicating liquor consumed by the general public. The State, under its police power, exercises the right to regulate the practice of certain trades, professions, etc., and this has proved by experience to be a policy in the interest of the people as a whole. See Local Option.

Certain licenses imposed by municipalities or States have been held unlawful by the Federal courts of the United States, as a tax upon drummers soliciting orders for firms in another State, a license tax upon an agent of a railroad company doing interstate business, and likewise upon a telegraph company doing interstate business.

LICH OWL, or **LITCH OWL** (A. S. *lic,* a body, and *ule,* an owl), a provincial British name for any owl, which screams at night, and is superstitiously regarded as portending death. From the earliest ages the hoot of the owl has been regarded as ominous. Ovid, Virgil and Shakespeare contain many illustrations of this common superstition. See LICHGATE.

LICHENS, lī-kĕnz (Lat. *lichen,* lichen, Gr. *λειχήν*), a large but artificial group of the higher fungi (*Carpophyta*), characterized by parasitic growth upon the lower blue-green and yellow-green algæ (*Protophyta, Chlorophyceæ*). Lichens are of the wildest occurrence in nature, appearing as gray, yellow and brown crusts or masses almost everywhere upon trees, rocks and soil. The number of genera and species differs more or less with the authority cited: the valid genera number not far from 250, while the species are in the neighborhood of 4,000.

The vegetative body or thallus varies from a fraction of a millimeter to several decimeters in size, though it shows relatively little variation in thickness. In texture it is powdery, leathery, paper-like, or, in the case of many forms with blue-green algæ, gelatinous; the prevailing colors are gray, brown and yellow, while green and black sometimes occur. The shape of the thallus is typically orbicular or stellate; it is often irregular, especially in branched forms. In general appearance the thallus varies within wide limits; as a rule, however, three types, crustose, foliose and fruticose, may be clearly distinguished. The crustose type is the primitive one, showing in its granular, warty and areolate forms the various stages through which the thallus has passed in its development from the original mycelium. The crustose thallus is so closely in contact with its substratum that it cannot be separated from it without tearing. The foliose type is a higher development of the crustose. It is usually a definite, leaf-like structure, more or less lobed at the margin and attached to the stratum somewhat loosely or at but a single point. The fruticose type is a special modification of the foliose, in which the latter is more or less flattened or cylindrical and erect or pendulous. This form is probably an adjustment to conditions of diffuse light. It is especially characteristic of tree-lichens and of certain ground forms, such as *Cladonia,* where it is termed the podetium. In the latter there is also developed an accessory or secondary thallus, consisting of minute, leaf-like scales.

The simplest thallus consists merely of a few fungus threads enclosing the irregularly disposed cells of the host or alga. Ordinarily, however, the algal cells not only have a definite position, but the fungal portion of the thallus is likewise highly specialized. Naturally, this differentiation is least in the crustose forms and greatest in the fruticose ones. The structure of the foliose type may be taken as fairly representative, except of the gelatinous lichens, in which the algæ are scattered throughout the thallus. A definite epidermal layer is wanting except in a few of the higher lichens, where the outer filaments have been gelatinized, resulting in the formation of a structure closely resembling a cuticle. As a rule, however, the uppermost part of the thallus is the cortical layer. This consists of hyphæ (filaments) compacted in such a way as to produce a tissue which looks much like parenchyma and is called in consequence pseudoparenchyma. The function of the cortical layer is in part mechanical or supportive and in part protective. Its structure seems to depend primarily upon the latter function: it is least in those forms growing in forests and greatest in those found in the open. Below the cortical layer and continuous with it is found the host or algal layer, consisting of filaments more or less loosely intertwined with the algæ. This is the nutritive layer, in which the fungal hyphæ draw their nourishment from the host-cells. The connection between the two may be merely by contact or by penetration. In the latter case the fungal hyphæ either penetrate the protoplasm of the host and finally destroy it, or merely pierce the cell-membrane and lie in contact with the protoplasm. In either event, the hyphæ develop special branches for contact or penetration, which are called haustoria. The algal layer is a specialized portion of the medulla which lies just below it. The hyphæ of the two layers are continuous, but they do not develop haustoria in the medulla, where they tend also to run more or less parallel with the direction of growth. The medullary layer primarily serves the function of transport; it is likewise used for the storage of lichenin (lichen-starch) and fats. The lower surface of the thallus is covered with a cortical layer similar in structure to that of the upper surface. Generally, however, it is somewhat thinner and is designed rather for absorption than for protection. It is frequently produced into facicles of hyphæ termed rhizoids and cilia.

The thallus of many lichens exhibits several peculiar structures, which are the direct result of the symbiosis of fungus and alga. The most frequent and most important of these is the soredium. This is a minute irregular mass of fungal hyphæ and algal cells, readily carried by wind or water, and able to grow directly into a lichen thallus under the proper conditions of moisture and warmth. Soredia occur upon the upper face of the thallus of many lichens as elevated powdery masses or tubercles. They arise in the algal layer of the thallus by the repeated branching of a fungal filament in such fashion as to completely enclose one or more cells of the alga, which also increase in number. The hyphæ become more or less gelatinized and compacted into a surface very resistant to desiccation. The soredia are pushed upward through the thallus by the growth of the filaments below and are finally extruded through a rift in the cortical layer, constituting a sorus. Normally, the soredia are carried away from the sorus and develop independently, but in some cases they grow while still in contact with the mother-thallus, producing minute, leaf-like scales upon the latter. These are the so-called isidioid growths or phylloclades, found in *Usnea* and related genera. Soralia are structures which arise from the medulla or even from the lowermost layer by the upgrowth of a mass of parallel filaments which penetrate the algal layer and there develop into normal soredia. Cephalodia bear the general appearance of soredia, but in origin and function they are quite different. They are distinguished as external and internal. The cause of their development is unknown: they are said to arise from the soredia of other lichens, which have lodged upon the thallus. They have never been produced experimentally, however, and it seems much more probable that they are modifications of the thallus due to a change in the life form of the algal element. The cyphellæ are flat or concave gaps in the lower cortical layer of the thallus of *Sticta* and *Stictina*. They are filled with variously branched hyphæ of the medullary layer and probably function as organs of absorption and respiration. The spermagonia are minute black dots occurring on the upper face of many lichens, especially near the margin of the thallus. Structurally they are identical with those propagative organs of black fungi that are termed pycnidia. They are spherical bodies with a membranous or carbonaceous envelope, containing a layer of rod-like filaments which bear at their tips tiny spore-like bodies called spermatia. As the names indicate, the spermagonia were supposed to be male reproductive organs and the spermatia the fertilizing cells. There now seems to be little doubt, however, that they are propagative organs or pycnidia inherited from fungus ancestors. In a few cases they may be pycnidial parasites, such as *Phyllosticta*.

The fruit (sporocarp) of those lichens which bear spore-sacs (ascolichens) is called a perithecium when the fungus is one of the black fungi (*Pyrenomycetales*), a hysterothecium, when it belongs to the cleft fungi (*Hysteriales*), and an apothecium when the lichen is a cup fungus (*Discomycetales*). All these agree essentially in structure, though they differ in form: the perithecium is globoid, opening by a minute pore at the top, the hysterothecium, linear or irregular, opening by a cleft, and the apothecium usually open and disc-shaped. The essential parts in each are the same, namely, spore-sacs (asci), the spores, and the sterile threads (paraphyses). The apothecium is the highest type of spore-fruit and the most widely distributed. It consists usually of the following parts: the thecium, the central portion consisting of the asci, sometimes called thekes, and the paraphyses; the epithecium, which lies above the asci; and the hypothecium which is found below them. The latter often extends around the sides of the thecium also, and is there termed the exciple (proper exciple, parathecium). All of these consist of densely compacted elongate hyphæ (prosenchyma) which are without algæ and are often more or less dark colored. In most of the higher lichens the exciple is surrounded by the tissue of the algal layer, producing a thalline margin (thalline exciple) about the apothecium. The apothecium usually sits directly upon the thallus; occasionally it is stalked, and less frequently it is immersed or innate. Lichens show the same differences with respect to paraphyses, asci and spores that are to be found among the other cup-fungi and black fungi. The paraphyses are simple or repeatedly branched, continuous or septate, gelatinized or non-gelatinized, persistent or evanescent. They are often compacted and dark-colored at the tip, appearing to be continuous with the epithecium. The spore-sacs of lichens are cylindrical or calvate in form, more rarely obovoid. Their walls are thin, though sometimes gelatinized; they do not react to iodine as a rule, except when very young. The asci usually open by a terminal slit; in a few cases the entire wall breaks away. The number of spores in an ascus varies from one (*Pertusaria*) to many (*Acarospora*); the normal number is eight, six or four. The arrangement of the spores is usually irregular, though they are sometimes in one row (monostichous), or in two rows (distichous). Lichen spores are ordinarily colorless and simple, less frequently dark brown and many-celled. They may be two-celled (bilocular), several-celled (plurilocular), or muriform, when the partitions run in both directions. The wall of the spore is smooth and without appendages; the contents may be hyaline, granular or guttulate.

Physiology and Reproduction.— The functions of lichens are essentially those involved in the relation between parasite and host, modified to an important degree in those forms with well-developed thallus. Absorption of water takes place readily upon both surfaces of the thallus, but especially on the under side, where hyphæ, cilia and rhizoids all act more or less efficiently as absorptive agents. According to Zukal, the hyphal hairs are capable also of absorbing moisture directly from the air, in *Physcia, Peltigera, Sticta,* etc. Water-storage takes place in the algal and medullary layers. It is effected primarily by the algal membranes, especially of the blue-green slimes, and to a degree also by the lichenin of the hyphæ. Zukal has suggested that the cephalodia, because of their blue-green algæ, are probably to be regarded as structures for the storage of water. The ability of the lichen thallus to retain water arises from its complexity, and from the presence of the gelatinized cortex. Lichens exhibit a number of somewhat primitive devices for the exchange of gases. These are often mere rifts in the thallus, or degenerate pycnidia; sometimes definite openings are present, or absorption takes place through loose protuberances. A specialized organ for this purpose is found in the cyphellæ of *Sticta* and *Stictina,* which are primitive breathing pores, making direct connection between the air and the medullary layer. The latter serves as a pathway for the transport of water and gases to the various parts of the thallus.

The relation of the lichen thallus to the environment is obscure. Of all macroscopic plants lichens resist drying-out the most successfully. With respect to the temperature extremes which they can endure, they are surpassed only by the bacteria. Many lichens withstand temperatures greater than 65° C, and nearly all are able to resist the intense cold of Arctic and Alpine winters, with minima of —40° to —60° C. Lichens exhibit very different sensibility to light: the majority of them grow in the fullest sunlight, while some, *Evernia, Usnea, Peltigera, Graphis,* etc., are adapted to more or less intense shade. In Alpine regions especially, orange and yellow thalli occur almost exclusively on the under, or shaded, side of rocks. This fact is explained by Zukal's researches, in which he found that the algal layer was most highly developed under a cortex orange or yellow in color, these colors being most penetrable by the rays active in carbon assimilation. The color of the cortex is also thought to be a protection against excessive illumination, though this explanation can scarcely hold for those lichens in which the lower cortex is highly colored. According to Schwendener, the growth of the thallus is largely intercalary, marginal or apical growth being relatively insignificant. In lichens with yellow-green algæ, the growth of the thallus is determined by the fungus, and the development of the algal layer takes place subsequently. In this process, the algæ and hyphæ show a tendency to aggregate into tubercles, which modify the surface of the thallus. Somewhat similar sculpturings are produced by tensions in the growing thallus, especially by the alternation of wet and dry periods. In nearly all the gelatinous lichens, and particularly those parasitic on filamentous algæ, growth is controlled by the alga, and the fungus has little or no influence upon it.

The propagation of lichens occurs ordinarily by means of soredia. It may take place also by fragments of the thallus, whether abstricted naturally or cut off by accident. The propagative value of the pycnidium (spermogonium) in nature is unknown. The conidia have been germinated in cultures with difficulty, and at present there is no evidence that they grow more readily under normal conditions. Reproduction is a characteristic feature of the lichens: a few species produce apothecia rarely, while in certain sterile forms they are never developed. It is still an open question whether the apothecium is the result of fertilization. Some investigators have thought to demonstrate the presence of a carpogone and trichogyne, and to follow the development of a spore fruit, which results from the contact of spermatium and trichogyne. The germination of many spermatia points strongly to the conclusion that these are mere conidia and not male sexual cells. No fusion of sexual cells has yet been seen in lichens, and, until this is seen, it is impossible to settle the question of their sexual nature. The apothecium arises usually from certain more or less distinctly twisted hyphæ lying between the medulla and the algal layer. Sometimes the point of origin is just beneath the cortex, especially near the margin, and in crustose forms it is in the hyphal layer just above the substratum. The development is essentially the same as in the other cup-fungi; the hyphal fundament increases in size, and becomes differentiated above into two sorts of threads. The first to grow up are the paraphyses, in the centre of which push up the club-shaped branches, which become the asci. Spore formation in the ascus follows the method typical of all sac-fungi. The escape of the spores takes place through a terminal rift in the ascus or by the breaking up of the latter. The mature spores germinate readily under the proper conditions, usually sending out a single filament from each cell; large spores, however, such as those found in *Megalospora* and *Pertusaria,* produce many germinating filaments. The young mycelium is capable of slight development only, unless it comes in contact with the proper alga, when it grows at once into the thallus. The uncertainty that the spores will germinate in a place where the proper host occurs makes multiplication by spores much less sure than by soredia. In a few cases (*Endocarpon, Staurothele,* etc.), this disadvantage has been overcome by the development of algæ in the thecium between the paraphyses and spore-sacs (hymenial gonidia). These are ejected with the spores, and, clinging to the latter, furnish a certain substratum for the germination of the spores.

Origin and Classification.— Lichens are sac-fungi and rod-fungi which show more or less similarity in their vegetative body because of their parasitism upon certain algæ. The clew to their origin and relationship is to be found in the inherited reproductive organ, the sporocarp, and not in the thallus. From this standpoint, the group is highly artificial, containing representatives of two distinct classes of fungi, the *Ascomycetes* and the *Basidiomycetes.* The basidiolichens are a small group, containing but a few genera: the ascolichens consist of the representatives of several unrelated families. It is evident that the lichens have not arisen from a single point, as members or offshoots of one line of development, but that they have originated at several widely separated points. They are of multiple origin; that is, they are polyphyletic. In ascolichens, the form of the sporocarp indicates the main places of origin: the *Verrucariaceæ,* with perithecia, are *Pyrenomycetales;* the *Graphidaceæ,* which show the hysterothecium, belong to the *Hysteriales;* the remaining families, *Caliciaceæ, Collemaceæ, Parmeliaceæ,* etc., belong to the *Pezizales.*

The following synopsis will indicate the relationship and limits of the various families of lichens:

Class Ascomyceteæ: fruit a sporocarp, spores borne in sacs (asci).

ORDER PYRENOMYCETALES: sporocarp a perithecium.

Family Sphæriaceæ: mycelium filamentous, saprophytic or parasitic on tissues.

Family Verrucariaceæ: mycelium thalloid, parasitic on yellow-green algæ.

ORDER HYSTERIALES: sporocarp a hysterothecium.

Family Hysteriaceæ: mycelium filamentous, hysterothecium carbonaceous.

Family Hypodermataceæ: mycelium filamentous, hysterothecium membranaceous.

Family Graphidaceæ: mycelium thalloid, on algæ, hysterothecium membranaceous or carbonaceous.

ORDER PEZIZALES: sporocarp an apothecium.

Apothecia and thallus leathery, waxy or carbonaceous, never gelatinous.

Family Patellariaceæ: mycelium filamentous, mostly saprophytic.

Family Lecidiaceæ: mycelium thalloid, apothecium sessile, exciple without algæ (proper).

Family Cladoniaceæ: mycelium thalloid of two sorts, primary and secondary; apothecia borne on stalks (podetia), proper exciple.

Family Parmeliaceæ: mycelium thalloid, algæ yellow-green, exciple with algæ (thalline).

Family Pannariaceæ: mycelium thalloid, algæ blue-green, proper exciple.

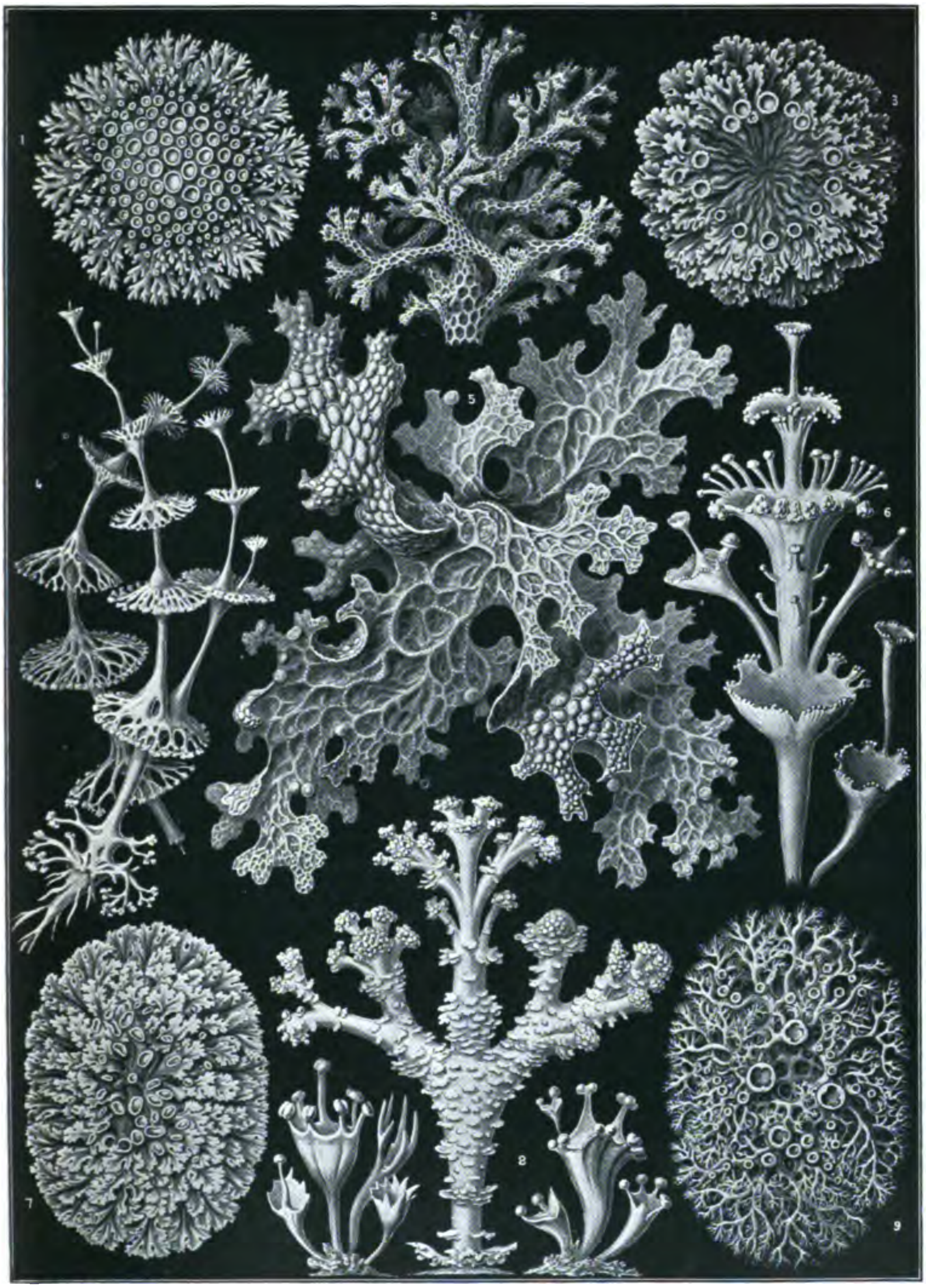
Apothecia and mycelium gelatinous.

Family Bulgariaceæ: mycelium filamentous.

Family Collemaceæ: mycelium thalloid, on blue-green algæ.

Class Basidiomyceteæ: fruit a hymenophore spores borne on stalks (basidia).

LICHENS



1 Parmelia stellaris
2 Cladonia retipora
3 Parmelia olivacea
4 Cladonia perfoliata
5 Sticta pulmonaria
6 Cladonia verticillata
7 Parmelia caperata
8 Cladonia squamosa (center); C. fimbriata (left); C. cornucopiæ (right)
9 Hagenia crinalis

Order Hymenomycetales: hymenophore exposed on a pileus.

Family Thelephoraceæ: hymenophore smooth, mycelium filamentous or thalloid (in *Cora, Rhipidonema, Dictyonema,* and *Laudatea*).

Order Gasteromycetales: hymenophore enclosed in peridium.

Family Sclerodermataceæ: peridium broad subsessile, gleba excavate, mycelium filamentous, or thalloid in Emericella.

Distribution and Rôle.— Lichens are distributed over the entire earth; they are least numerous in the tropics and reach their maximum development in Alpine and polar lands, where they often form the principal vegetation over immense stretches. Many species are widespread, especially in the northern hemisphere: some of these, such as *Cladonia rangiferina, Urceolaria scruposa, Usnea barbata,* etc., are truly cosmopolitan. In the tropical and temperate zones, the greatest wealth of lichens is found upon bark and wood. In Alpine and polar regions the stone and earth forms are predominant. In these places lichens play their most important part in the economy of nature. They take the initiative in the disintegration of the hardest rock by virtue of the acids secreted by the thallus; they are likewise very effective in binding together the new soils which result in this way and in contributing organic material by their decay. In all rocky habitats they are the pioneers which prepare the way for the appearance of more highly organized plants, mosses, grasses, etc. In the case of tree-lichens, the tree is not affected by the lichen, except in so far as the bark may be ruptured by it mechanically. It is a question whether lichens exert any really injurious effect upon timber, though they probably hasten the decay of boards, posts, etc., by increasing the amount of moisture present.

A few lichens are of value as food. The most important among these is the so-called «reindeer moss,» *Cladonia rangiferina,* which covers vast stretches in the north and constitutes an invaluable supply of food for the reindeer and caribou. In Japan, *Gyrophora esculenta,* which is collected in abundance in the mountains, is of sufficient importance to be an article of export. The arid regions in northern Africa and western Asia produce large quantities of the manna-lichen, which is used to make bread, especially by the Tartars. This lichen is readily torn away from the substratum by the wind and is carried often to considerable distance before falling as «manna rain.» This phenomenon has been observed repeatedly in modern times, and probably accounts for the manna of the Israelites. «Trip-de-roche» is an edible *Umbilicaria* of Arctic America, but the presence of the bitter principle so common in lichens restricts its use as a food. Lichens owe their food value almost wholly to their high content of lichenin, or lichen-starch. Lichens, though once of extensive application in dyeing and in medicine, have fallen almost completely into disuse in both. The various kinds of orseille, which were made from *Roccella tinctoria* and held in high esteem for their brilliant purples have been entirely replaced by the aniline dyes. Litmus, which is a similar dye made from a species of *Lecanora,* is still extensively used in chemistry because of its red coloration in the presence of an acid. «Iceland moss,» *Cetraria islandica,* is still used officially: it contains cetrarin, a bitter principle which is tonic and astringent, and a large amount of lichenin.

Consult Hale, E. H., ‘Flowerless Plants’ (New York 1909); Massee, G. E., ‘British Fungi’ (ib. 1912); Marshall, ‘Mosses and Lichens’ (ib. 1907); Tuckerman, E., ‘Synopsis of the North American Lichens’ (Amherst 1882); Schneider, A., ‘A Textbook of General Lichenology’ (1897); Schneider, A., ‘Guide to the Study of Lichens’ (Boston 1898); Sargent, F. L., ‘Lichenology for Beginners’ (Cambridge 1906).

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LICHFIELD, lich'fēld, England, episcopal city and civic county of Stafford, 17 miles southeast of Stafford. The principal edifice is the cathedral, a noble structure of early English and transitional architecture with a richly decorated west front, and three spires — two on the west, each 180, and one in the centre 280 feet high. Its length internally is 370 feet, and breadth of nave 68 feet. Among other notable monuments is Chantry's celebrated recumbent figures of the «The Sleeping Children.» The cathedral suffered greatly during its sieges in the civil wars from 1643 to 1646, and was restored by Wren. The see of Lichfield was founded in 656, and the city's charter dates from 1549. The city has interesting literary associations, Johnson, Addison and Garrick, born in the town or neighborhood, having been educated at the old grammar school. Johnson's house is now a Johnson Museum. Brewing and carriage and harness works form the principal industries. Pop. 8,616.

LICHNOWSKY, Prince Karl Max, German diplomat: b. 8 March 1860. His father was Prince (Fürst) Lichnowsky, a general of cavalry, and his mother a Princess of Croy. He is the head of an old noble Bohemian family and of immense wealth, possessing estates at Kuchelna in Silesia and Gratz in Austria. As an hereditary member of the Upper House of the Prussian Diet he has played some part in domestic politics, adopting in general a moderate attitude and deprecating party legislation. Though a Roman Catholic, he steadily avoided identifying himself with the Clerical party in Germany. Entering the diplomatic service, the prince was appointed an attaché at the London embassy in 1885 and later served as legation secretary at Bucharest and as councillor of the German embassy in Vienna. He was for a time employed in the Foreign Office in Berlin, and on his marriage, in 1904, to the Countess Mechthilde von und zu Arco-Zinneberg, he retired to his estate with the rank of Minister. «I spent my time on my farm and in my garden, on horseback and in the fields, but I read industriously and published occasional political articles. . . . Thus eight years passed.» For several years newspaper rumor in Germany had connected the name of Prince Lichnowsky with practically every important diplomatic post vacant from time to time, and even with the Imperial Chancellorship. No official appointment was forthcoming, however, beyond the designation of «Wirklicher Geheimrat» or Privy Councillor, in 1911. In October 1912, Prince Lichnowsky, «to his great surprise,» was offered the post of Ambassador to Great Britain. In May of that year Count Wolff-Metternich, then German Ambassador in London, retired and was succeeded by Baron Marschall von Bieberstein (q.v.). The latter, however, died in September. Prince Lichnowsky, who was «inclined to think that they settled on him as no other candidate was available,» held the post in London until the outbreak of the European War. He had always been credited in England with a sincere desire to encourage friendly relations between his country and Great Britain, and on numerous occasions at festive gatherings in London and the provinces had expressed his earnest wish that the two nations should work harmoniously in the cause of civilization. Little mention is made in official publications of the prince's diplomatic activity in London, especially during the final crisis. Various interpretations have been placed upon the reports he submitted to his government on the attitude of England. After his return to Berlin he assured the American Ambassador there that he had «correctly reported the sentiments of England in saying that England did not want war» (Gerard's 'My Four Years in Germany,' pp. 100–102). At all events, according to Mr. Gerard, «the Germans quite unfairly treated him as a man who had failed.» An illuminating analysis of German foreign policy, written by Prince Lichnowsky in retirement during 1916 for his private family archives, found its way into the press and created a profound sensation in March 1918. Prince Lichnowsky was expelled from the Prussian House of Lords in July 1918. See LICHNOWSKY MEMORANDUM; WAR, EUROPEAN — DIPLOMATIC HISTORY.

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LICHNOWSKY MEMORANDUM, a remarkable document and a valuable contribution to the pre-history of the European War, written in retirement of Prince Lichnowsky (q.v.), former German Ambassador in London. Under the title of 'My Mission to London, 1912–1914' and dated «Kuchelna (Prussia) August 1916,» the ex-Ambassador reviewed the course of German foreign policy and diplomatic relations, which, in his opinion, were directly responsible for the war. The document, it appears, was written by the prince for his private family archives as well as to explain and justify to his personal friends his position as the representative of Germany in England at the outbreak of the war, and the part he had played during the crisis. Its contents were of a kind which would normally not have been available till after many years, till the chief actors had passed away. At first only a few typewritten copies were made, one of which — by a breach of confidence — reached the German Foreign Office, while another copy appears to have fallen into the hands of the minority Socialist party in the Reichstag, by whom, in all probability, it was communicated to the *Politiken*, a Socialist newspaper in Stockholm, Sweden. Early in March 1918 that journal began to publish extracts from the memorandum, the omitted portions having been suppressed by the Swedish government. In April it transpired that a member of the German deputy general staff, Capt. Hans von Beerfelde, had had numerous copies made and had sent them to the Crown Prince and various military and political leaders. After the first partial publication by *Politiken*, the German government made strenuous efforts to prevent further disclosures, but by the end of March 1918 the whole document had become public property and caused a profound sensation. Reproduced all over Europe, as well as in *Vorwärts*, the German Socialist organ, the «revelations» of Prince Lichnowsky were formally debated by the Main Committee of the Reichstag on 16 March 1918. On that occasion the Vice-Chancellor, Herr von Payer, read a letter of apology, dated 5 March and addressed to the Imperial Chancellor by Prince Lichnowsky, in which the latter expressed his regret that the document had been made public against his wishes, and declared that it had leaked out in the summer of 1917, after the fall of Bethmann-Hollweg (q.v.). The prince resigned his rank as Minister and was placed under police surveillance on his estate. Criminal proceedings, on a charge of high treason, were ordered to be instituted against him. Captain Beerfelde was later arrested and charged, at first, with having taken part in promoting a peace strike in Berlin during January 1918. So far as could be gathered outside of Germany, no further steps had been taken in the matter up till the summer of 1918.

Although the memorandum contained much information that was already embedded in official and unofficial publications, there still remained certain gaps to be filled in the knowledge hitherto inaccessible — evidence which could only be supplied by the man who was the mouthpiece of the German government during the critical days immediately preceding the conflict, and who was the recipient of the proposals put forward by the British government. The general style of the document, with its small personal touches and certain unimportant inaccuracies, indicates that it was not intended for publication; in tone it is a clear and simple testimony to what really happened by one who played a prominent part in the events which he recalls. In effect it is an indictment of the whole policy of the German Foreign Office spread over many years, and a severe criticism of the cardinal point of that policy — the alliance with Austria-Hungary. That alliance, the author contends, has ever been a source of weakness to Germany, in that it ruined any hopes of an understanding with Russia, with the result that instead of being made subservient to German interests, Germany had eventually found herself in the position in which she was compelled to subordinate her own interests to those of a weak and decrepit ally. Prince Lichnowsky raises some great historical questions on which divergent views will always exist. These, however, are mainly of interest to Germany. By far the most important statements he makes are those in which he endeavors to fix the responsibility for the European War. He emphatically asserts that the British government, and particularly Sir Edward (now Viscount) Grey and Mr. Asquith, went to the very limit of what was possible in order to prevent the conflict. He ridicules the German theory that the war was treacherously plotted by «vengeful France, barbaric Russia and envious England» against a peace-loving fatherland. «I was treated like a departing sovereign. Thus ended my London mission. It was wrecked, not by the perfidy of the British, but by the perfidy of our policy . . . I had to support in London a policy which I knew to be fallacious.» In conclusion, Prince Lichnowsky prophesies that «the program of the great Rhodes, who saw the salvation of mankind in British expansion and British Imperialism, will be realized.» As a result of the war he believes that the world will belong to the English-speaking races, the Russians and the Japanese, while Germany «will remain alone with Austria and Hungary . . . The German appeared too late, and the World War has destroyed the last possibility of catching up the lost ground, and of founding a Colonial Empire.» See WAR, EUROPEAN — INTRODUCTION; DIPLOMATIC HISTORY. Consult ‘Current History’ (New York, May–June 1918); *New York Times* of 21 April 1918; ‘Revelations of Prince Lichnowsky’ (pamphlet, New York 1918).

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LICHTENBERG, Georg Christoph, gā-ōrg′ krĭs′tŏf lĭh′ten-bĕrg, German satirical writer and physicist: b. near Darmstadt, 1 July 1742; d. Göttingen, 24 Feb. 1799. He was educated at the University of Göttingen and became professor there in 1767. During frequent visits to England he collected material for his explanations of Hogarth, whom he thus assisted to popularize in Germany. He gained great celebrity as a lecturer on physical science. He being a hunchback may very possibly have embittered him and sharpened a naturally satirical disposition. The best of his satires are those on the notorious literary pirate, Tobias Göbhard; the essay on ‘The German Novel’; ‘Timorus,’ ridiculing Lavater's zeal for proselytizing; and ‘Pronunciation of the Wethers of Ancient Greece,’ aimed at Voss' system of pronouncing Greek. His brilliant sayings have been collected and published in a separate volume, ‘Lichtenberg's Thoughts and Maxims: Light Rays from his Works’ (1871).

LICHTENBERG, Leopold, American musician: b. San Francisco, Cal., 22 Nov. 1861. In early childhood he showed his fondness for the violin and received careful training. In his 12th year was asked by Henri Wieniawski, then on a visit to California, to become his pupil, and accordingly spent three years at Brussels Conservatory. Fresh from his European successes, he was engaged in 1877 in Theodore Thomas' orchestra and then spent three years more abroad playing in the chief cities. On his return to America he became a member of the Boston Symphony Orchestra and later was appointed head of the violin classes at the National Conservatory of Music, New York. With Adèle Margulies (piano) and the cellist, Leo Schulz, he formed the Margulies Trio, which became one of the foremost chamber-music organizations of the United States.

LICHTENSTEIN, one of the most popular of German historical novels (1826) and the masterpiece of Wilhelm Hauff, a Suabian novelist and poet who died full of promise at the age of 29, was a romantic and patriotic German's tribute to the work of Sir Walter Scott. No foreign author was more popular than Scott in the Germany of the early 19th century. His novels, translated in full, were so generally read that it was said that the soil of old Scotland was more familiar to Germans than their native land. Yet the hills of Scotland, Hauff said, were not of a richer green than the German Harz, the waves of the Tweed were no bluer than those of the Donau, Scotch men were no braver, Scotch women no lovelier than the old Suabians and Saxons. Lichtenstein, modeled after the Waverly novels, was a direct protest against the novel with a foreign historical background and was an attempt to recreate the romance of a bit of Suabian history (the reign of Ulrich of Württemberg in the 16th century) as Scott had done for the country of Ivanhoe and Waverly. But Hauff lacked the genius and scholarship of Scott, although he was a brilliant story-teller, full of the enthusiasm and the romance of youth, full of his own love-story which he permitted to add a glow to his pen-portraits, and with a rare sense of humor. And Lichtenstein, failing of historical value, has succeeded in making its own place as one of the picturesque love stories of German literature.

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LICINIUS, lĭ-sĭn′ĭ-ŭs, **Gaius,** Roman tribune. He came of a plebeian family, but rose to the rank of tribune, receiving the surname of Stolo, or Useless Sprout, by reason of the law which he established forbidding any one to possess more than 500 acres of land. His reason for this was that when more land was cultivated by any one owner the latter could not pull up the useless shoots (*stolones*) which grew from the roots of trees. Another law of his enactment allowed the plebeians to share the consular dignity with the patricians; and he himself became one of the first plebeian consuls, 364 B.C.

LICINIUS, Gaius Flavius, Roman emperor: b. Dacia, about 270; d. 324. He was made Augustus by the emperor in 307, and became emperor of Rome after the death of Galerius about 312. He was defeated by his brother-in-law, Constantine, 323, and put to death the year following. His son, Flavius Valerius, declared Cæsar in 317, was slain at Constantinople in 326.

LICK, James, American philanthropist: b. Fredericksburg, Lebanon County, Pa., 25 Aug. 1796; d. San Francisco, Cal., 1 Oct. 1876. In 1821 he set up in the pianoforte business at New York, and later was a manufacturer of musical instruments at Buenos Aires, Philadelphia, Valparaiso and elsewhere. In 1847 he went to California, where he gained wealth through investments in real estate and various enterprises. In 1874 he placed $3,000,000 at the disposal of seven trustees, by whom they were to be applied to specific uses. The principal divisions of the funds were: To the University of California, for the construction of an observatory and the placing therein of a telescope to be more powerful than any other in existence, $700,000 (see LICK OBSERVATORY); for the building and maintenance of free public baths in San Francisco, $150,000; to found and endow an institution of San Francisco to be known as the California School of Mechanic Arts, $540,000; for the erection of three appropriate groups of bronze statuary to represent three periods in Californian history and to be placed before the city hall of San Francisco, $100,000; to erect in Golden Gate park, San Francisco, a memorial to F. S. Key, author of ‘The Star-Spangled Banner,’ $60,000.

LICK OBSERVATORY, astronomical department of the University of California. James Lick (q.v.), by deeds made in 1874 and 1875, charged a board of trustees to expend the sum of $700,000 for the purpose of purchasing land and constructng «a telescope superior to and more powerful than any telescope yet made . . . and also a suitable observatory . . to be made useful in promoting science.» Under the provisions of this deed a site was selected in 1876 on the summit of Mount Hamilton about 26 miles, by road, from San José, Cal. The land (about 3,000 acres) was granted at various times by the United States and by the State of California.

Astronomical observations of precision and delicacy require a steady atmosphere as well as a very transparent one, and the site chosen is favorable in both respects. This was thoroughly tested in 1879 by Prof. S. W. Burnham before any buildings were erected. The first board of trustees (D. O. Mills, president) chose as chief advisers Profs. Simon Newcomb and Edward S. Holden, and appointed Professor Holden as director. In October 1874 the latter submitted a plan for the building of the observatory and a program of work, which were accepted by the trustees, according to which the buildings were constructed and the work carried on from 1874 to 1897. The county of Santa Clara built a fine mountain road to the summit, in 1876, at a cost of $78,000. The work of construction was begun in 1880 by the third board of trustees (Capt. R. S. Floyd, president) with Thomas Fraser as superintendent. To obtain a level platform for the observatory 70,000 tons of rock were blasted from the summit. The instruments were ordered from specifications by Dr. Holden, except the object-glass of the great telescope. After a series of experiments Professor Newcomb advised the construction of a refracting telescope for the main instrument of the observatory. The glass discs were founded by Feil and Mantois of Paris and figured by Alvan G. Clark. The finished objective is 36 inches in diameter, and has a focal length of 56 feet 2 inches. Besides the visual objective, there is a third lens of 33 inches aperture. When this is placed in front of the visual objective the combination becomes a photographic object-glass of 570 inches focal length (the diameter of the photographic image of the moon is about 5.2 inches). The cost of the visual objective was $50,000, of the photographic corrector about $13,000, and of the mounting of the telescope about $45,000. The cost of the dome complete was about $85,000; of the whole observatory about $610,000. The mounting of the great telescope was made by Warner and Swasey, of Cleveland. The whole weight of iron pier and mounting is about 37 tons. The moving parts of the latter weigh about seven tons; the tube weighs nearly three tons. The telescope is used for visual purposes, and micrometer measurements; it is also used for photographic and for spectroscopic observations. Its steel dome is 75 feet in diameter, and weighs 100 tons. It was built by the Union Iron Works of San Francisco. The floor of the dome is movable vertically (about 16½ feet), according to a plan by Sir Howard Grubb, which ensures a convenient position for the observer, no matter whether the telescope is pointing horizontally or vertically. Other instruments are a 12-inch and a 6-inch refractor, a 4-inch comet-seeker, a 6-inch meridian-circle, a 5-inch photographic telescope, a 4-inch transit, a 5-inch photoheliograph, etc.

The great telescope has been in constant use since its erection, and its optical quality has been proved to be excellent. The admirable design and construction of its mounting and dome have much facilitated its work. In 1895 Edward Crossley, M.P., of Halifax, England, presented to the observatory his 3-foot reflector, which has been a powerful auxiliary to the great refractor. The observatory constitutes the Lick Astronomical Department of the University of California. Its staff has comprised many noted observers: Messrs. Burnham, Barnard, Schaeberle, Tucker, Perrine, Hussey, Aitken, Wright and others.

The observatory was one of the very first to be located on a site specially chosen for its adaptation to astronomical work, and its success has had an important effect upon the science of practical astronomy. No one would now think of locating a great observatory without careful consideration of the site to be occupied. The mountain observatories of the world owe much to the experiments made at Mount Hamilton.

The principal objects of research have been: The visual and photographic observation of planets and satellites; the fifth satellite of Jupiter was discovered here by Barnard in 1892. A systematic search for comets has been kept up and 14 unexpected comets have been discovered — Barnard (3), Perrine (9), Coddington (1), besides a comet discovered by Schaeberle during his observations of the solar eclipse in Chile. Many periodic comets have also been detected and observed. The orbits of new comets have always been promptly computed at the observatory and ephemerides sent out to other stations. Four asteroids were discovered by Coddington in 1898–99. Meteors have been observed and photographed, and their orbits calculated. Double stars have been assiduously observed and many new discoveries made by Burnham, Hussey and Aitken; the orbits of a considerable number of binaries have been calculated. Observations of the zodiacal light and of the aurora have been made by Barnard and others. Successful expeditions have been sent to observe all total solar eclipses since 1888, and very much has been added to our knowledge of solar physics in this way. The transit of Venus of 1882 and three transits of Mercury have been observed and photographed here. The positions of a large number of fixed stars have been determined with great precision by Tucker. Many photographs of the sun and moon have been made. The negatives of the moon have been utilized in the preparation of an atlas of the moon (scale 10 feet to the moon's diameter) by Professor Weinek, and on a scale of three feet by Messrs. Holden and Colton. A great number of important photographs of the milky way were made here by Professor Barnard and others, and of comets and nebulæ by Keeler, Hussey, Perrine and others. A complete outfit of seismometers for recording the intensity of earthquake shocks was installed at the observatory in 1888, and it was supplemented by similar instruments at Berkeley and at other points in California and Nevada, which regularly report to Mount Hamilton. In this way the elements for seismometric record for the State were collected and regularly published. At the same time a list of all recorded shocks on the Pacific coast since 1769 was compiled and discussed by Dr. Holden. Spectroscopic observations of nebulæ, new stars, comets, stars and planets have been made in great number and with previously unattained precision by Messrs. Keeler, Campbell, Wright, Perrine and others.

The chief problem of the great telescope is to determine the motion of the solar system by spectroscopic observations. The photography of stellar spectra was proposed in the plan of 1874 and attacked in 1888, and it has been followed with marked success, especially in the hands of Professor Campbell. Since 1896 more than 2,000 negatives of stellar spectra have been secured. A preliminary discussion by Campbell leads to the result that the solar system is moving toward a point in 277° R. A. and 20° N. D., at a speed of 19.89 kilometers (12.35 miles) per second. An expedition was sent (at the expense of D. O. Mills) to the southern hemisphere in 1903 to extend this research to southern stars.

The observatory publishes a series of octavo ‘Contributions’ (No. 1 in 1889, No. 5 in 1895), of quarto ‘Publications’ (1887 et seq.) and a quarto *Bulletin* since 1901 — a journal. The Astronomical Society of the Pacific, founded by Professor Holden in 1889, has close relations with the observatory, and has printed 15 octavo volumes. Visitors are freely admitted to the observatory in the day time to the number of 5,000 or more annually. On Saturday evenings visitors are admitted to look through the telescopes, and as many as 150 to 200 are frequently registered. In this way the observatory has rendered important services to popular education.

LICKING, (1) a river of Kentucky, rising in Floyd County, among the Cumberland Mountains, and, after a course of about 200 miles, falling into the Ohio at Newport, opposite Cincinnati. (2) A river of Ohio, the former Indian Pataskala, rising near the centre of the State, and, after a course of 80 miles, flowing into the Muskingum near Zanesville. It furnishes valuable water power.

LICORICE, or LIQUORICE, a genus of perennial herbs (*Glycorrhiza*) of the order *Leguminosæ*. About a dozen widely dispersed species are recognized, of which *G. glabra* is the most important, since it furnishes the licorice of commerce. It is characterized by long rootstocks, odd-pinnate leaves and racemes of separated flowers of various colors, usually pale violet. The plant is a native of southern Europe and western Asia, and is cultivated in Spain, Italy, Russia and some other countries of the Old World, the best grades coming from the first two countries mentioned. The roots and the extracted sweetish principle, of which about $500,000 worth are imported into the United States annually, are used in making plug tobacco and porter, to flavor cooling drinks and by druggists to disguise the unpleasant taste of some drugs. Attempts to cultivate the plant in Louisiana and California have proved partially successful, but the crop is not profitable, since three to four years must elapse before it can be dug, and the selling price is small. Cuttings of rootstock are planted about three feet apart, and when established the plants are allowed to shift for themselves until harvest, when the land is plowed and the rootstocks are pulled bv hand. No further planting is necessary, since the bits of root left will restock the land.

LICTORS, in ancient Rome, a name given to those public servants who attended upon the chief magistrates to fulfil their commands, bearing axes tied up in bundles of rods, which were called *fasces*. When a magistrate of high rank appeared in public the lictors preceded him in a file, following each other. It was their duty to clear the road of the populace. The dictators were preceded by 24 lictors; the consuls, decemvirs and military tribunes, by 12; the provincial prætors, master of the horse and proprætors, by six; and the quæstors by five.

LIDDELL, lĭd'ĕl, **Henry George,** English classical scholar and Anglican clergyman: b. near Bishop, Auckland, 6 Feb. 1811; d. Ascot, Berkshire, 18 Jan. 1898. He was educated at the Charterhouse and Christ Church, Oxford; took priest's orders in 1838; and for some years lived in Oxford as a tutor of Christ Church. He took no part in the theological controversies which stirred the Oxford of his time, but worked steadily with R. A. Scott of Balliol, afterward dean of Rochester, at the ‘Greek Lexicon’ — the well-known ‘Liddell and Scott’ of successive generations of students — which forms his chief title to remembrance. It first appeared in 1843, but has undergone extensive revision and enlargement in subsequent editions, of which the eighth appeared in 1897. In 1846 Liddell was appointed the head-master of Westminster School, and from 1855–91 was dean of Christ Church. Besides the ‘Lexicon,’ founded on the Greek-German lexicon of Passow, he wrote a ‘History of Rome’ (1855), afterward abridged as ‘The Student's Rome.’ Consult Thompson, ‘A Memoir of H. G. Liddell’ (1899).

LIDDON, lĭd'ŏn, **Henry Parry,** English preacher and theologian: b. North Stoneham, Hampshire, 20 Aug. 1829; d. Weston-super-Mare, 9 Sept. 1890. He was educated at King's College School and Christ Church, Oxford, where he was graduated in 1850. He was ordained to the priesthood in 1853, and in the following year he was appointed vice-principal of Cuddesdon College, which Bishop Wilberforce of Oxford had recently founded, but as his uncompromising High Church teaching made him the object of suspicion, he resigned in 1859 and became vice-principal of Saint Edmund's Hall, Oxford. In 1870 he was chosen as Ireland professor of exegesis at Oxford, but after the Universities Commission had completed its work and issued its reforms, which he looked upon as desecration, he resigned (1882). From 1870 till his death he was canon of Saint Paul's and his sermons under the dome attracted crowds of breathless hearers. He was in fact the last prominent survivor of the theological school represented by Pusey and Keble and carried its tradition even into the period of the new Oxford movement represented by ‘Lux Mundi,’ a work by Charles Gore (q.v.) which he ardently controverted. He also was prominent in the controversies concerning the Public Worship Regulation Act, which he opposed, and the Athanasian Creed, which he defended. An inflexible High Churchman, an uncompromising theologian of the Nicene school and the greatest Anglican pulpit orator of his generation, he had much influence even where his rigid dogmatism carried no conviction, through the loftiness of his personal character, his transparent sincerity and a noble eloquence, whose power and sweetness recalled the best utterances of Bossuet and Massillon, preachers on whom he palpably bestowed much earnest study. During the last years of his life he was engaged in writing Pusey's life on a voluminous scale, but had completed but three volumes when he died. He was elected bishop of Edinburgh, in 1886, while traveling in the East for his health, but his decline prevented him from accepting. He published many sermons, but the only series likely to prove of permanent importance is his Bampton Lectures ‘On the Divinity of Our Lord and Savior Jesus Christ’ (1866), which has run into many editions. Consult Donaldson, A. B., ‘Five Great Oxford Preachers’ (London 1900); Johnston, J. O., ‘Life and Letters of H. P. Liddon’ (London 1904); Russell, G. W. E., ‘H. P. Liddon’ (London 1903).

LIE, lē, **Jonas Lauritz Edemil**, Norwegian novelist: b. Eker, Norway, 6 Nov. 1833; d. Christiania, 5 July 1908. He was educated at the University of Christiania, where he cultivated the friendship of Björnson and Ibsen, and in 1859 settled as a lawyer at Kongsvinger. He went to Christiania in 1868 to support himself by journalism and literary work and in 1870 became famous with his novel ‘The Visionary.’ The profits from its publication enabled him to spend some time in northern Norway and to visit Holland, Belgium, France and Italy. Returning in 1874, he received the poet's pension from the Storthing, resided in Dresden 1877–81 and from 1882 till 1891 lived in Paris in comparative retirement, writing his most notable works, and in the latter year he went to Rome, from which he returned in 1892 to Norway. The following are his chief novels and stories: ‘Stories and Sketches of Norway’ (1872), containing the story entitled ‘The Horse of Nordfjord’; ‘The Three-Master Future, or Life in the North’ (1873), a series of loosely connected stories or sketches dealing with the life of Norwegian seamen; ‘The Pilot and his Wife’ (1874), showing a considerable advance on his earlier works; ‘Thomas Ross’ (1878); ‘Adam Schrader’ (1879); ‘Rutland’ (1880); ‘Forward! Scenes of the Sea’ (1882); ‘Life's Slaves’ (1883), a powerfully realistic study of a soul involved in the net of circumstance; ‘The Family of Gilje’ (1884), a lighter story of Norwegian life; ‘The Gulf’ (1885), treating of the gradual decline of an old Norwegian family; ‘Eight Stories’ (1885); ‘The Commandant's Daughters’ (1886), by many regarded as his masterpiece; ‘Two Lives’ (1887), a penetrating study in the psychology of marriage; ‘Maisa Jons’ (1888); ‘Mischievous Powers’ (1889); ‘Trold’ (1891–92); ‘Niobe’ (1893), in which his subject is family troubles arising out of differing social, political or religious views held by parents and children; and ‘Grandfather’ (1895); ‘Wulffie and Co.’ (1901). He published a volume of poems in 1867 and he also wrote several dramas, ‘Faustina Strozzi’ (1875); ‘Grabow's Cat’ (1880) and ‘Merry Wives’ (1894). In 1894 he published an important critical work, ‘Honoré de Balzac, The Man and the Artist.’ Lie's chief works were translated into German, English and other languages. He was a realist who, however, avoided the excesses of his school, was especially happy in his portrayal of sailors and the sea and was gifted with a fine sense of humor and profound sympathy with the humble and the unfortunate and was a master in psychological analysis. A uniform edition of his works was published at Copenhagen in 15 volumes (1902–04). See The Pilot and His Wife.

LIE, a statement, which is thought to be false by the person who utters it and is intended to be believed by another. Lying has been recognized as an evil by many different religions and civilizations and there is probably no race which does not consider a lie as evil, provided it is asserted under some sacred form of oath. The evil of lying is due to the fact that communication between different individuals is a necessity of life, and that unless the truth is communicated much more often than a falsehood, a communication will come to have no meaning to its recipient — that is, will come to be no communication at all. This was well brought out by Kant, who pointed out that a community would be impossible in which lying was the rule, for then a lie, by ceasing to convey the false opinion which it is meant to convey, would cease to be a lie at all. There is no need, however, of making the evil of lying depend, after the fashion of Kant, on a categorical imperative which permits no action that cannot be willed as an example of a universal maxim of conduct. While lying involves in general evil consequences, it does by no means follow that every lie is an evil deed, in the sense that it is worse than the telling of the corresponding truth, or even worse than silence. Though a word is a medium of communication, it is often much more. To tell a burglar the combination of the safe is as much the act of an accomplice as to put a key into his hands. To tell a sick man that he is incurable may be on the same moral plane as to blow out his brains. On the other hand, the deception of an enemy spy has consequences not very different from those of repelling a hostile attack. Thus it may be seen that besides its truth-value, a proposition very generally has a moral value only indirectly connected with its usefulness in communication and often directly counter to the latter. Which of the two shall then preponderate is a matter which must be decided on the merits of each particular case. A great many accusations are brought against the sincerity of modern society on the basis of little untruths popularly called white lies. These range from the «Dear sir» and «Respectfully yours» which begin and end a letter, to the conventional «not at home» of a person who does not wish to be disturbed, or the perfunctory applause which follows a boresome lecture. These are in no proper sense lies, for the essence of «lying resides in the wilful transmission of a false belief to another,» and not in any form of words used in an especial sense. It is, therefore, useless to speak of a conventional lie, for a conventional form of expression is an expression which by frequent repetition has come to have a single universal interpretation — perhaps the interpretation of a meaningless form. It must, therefore, be interpreted by its hearer or reader in the precise sense intended by its user unless its user has gone out of his way to employ it in an extraordinary and unconventional sense. A lie need not be conveyed by written or spoken language. A look or a gesture may well be intended by one person to give a definite impression to another. If this impression is thought to be false by the person who conveys it, the look or gesture is a lie. Silence itself is enough to constitute a lie if it has the purpose of deception.

LIEBER, lē'bėr, **Franz**, American publicist: b. Berlin, Germany, 18 March 1800; d. New York, 2 Oct. 1872. He volunteered as a soldier at 15 and was in the battles of Ligny, Waterloo and Namur. He served also in the Greek war of independence, recording his experiences in ‹Journal in Greece› (1823). He settled in the United States in 1827 and during the next five years was occupied with the compilation of an ‹Encyclopædia Americana› (13 vols.). While professor of history and political economy in South Carolina College (1835–56), he wrote the three great works by which he is best known, ‹Manual of Political Ethics› (1838); ‹Legal and Political Hermeneutics or the Principles of Interpretation and Construction in Law and Politics› (1839); ‹Civil Liberty and Self Government› (1853). In 1857 he became professor of history in Columbia and later of political science in the Columbia Law School. During the Civil War period he was a firm supporter of the Federal government and was frequently consulted by the Secretary of War. His war code, officially designated as ‹Instructions for the Government of the Armies of the United States in the Field› (1863), made him still more widely known. He was a member of the French Institute and of many learned societies at home and abroad. Consult ‹Lives› by Perry (1882); Harley (1899).

LIEBER, Oscar Montgomery, American mineralogist and chemist: b. Boston, Mass., 8 Sept. 1830; d. Richmond, Va., 27 June 1862. He was a son of Franz Lieber (q.v.) and was educated at the universities of Berlin and Göttingen and the School of Mines at Freiberg, Saxony. In 1850 he became State geologist of Mississippi and afterward engaged in the survey of Alabama and South Carolina. In 1860 he went to Labrador as geologist of the American astronomical expedition. During the early part of the Civil War he served in the Confederate army and was fatally wounded at the battle of Williamsburg. He published ‹The Assayer's Guide› (1852); ‹The Analytical Chemist's Assistant› (1852); ‹Geology of Mississippi› (1854).

LIEBIG, Justus, yoos'toos lē'bĭg, BARON VON, German chemist: b. Darmstadt, 12 May 1803; d. Munich, 18 April 1873. He studied in Bonn and Erlangen, was graduated in 1822 and the same year went to Paris, where he gained the favor of Humboldt by his paper on fulminic acid and the fulminates, read before the French Academy (1824). He thus obtained access to the private laboratory of Gay-Lussac. In 1824 he was appointed extraordinary professor and in 1826 ordinary professor of chemistry at Giessen. Here he opened the first experimental laboratory for college students and the university soon became the European centre of chemical studies. He had remarkable success as a teacher and pupils streamed into his classroom from every country. The most illustrious chemists of the last century acknowledged their obligations to him as their master. He gave chemistry a settled position in Germany and turned it into a real science to be taught and learned by means of experiment. As an original investigator in the domain of chemistry he has shown himself a reformer of the sciences of physiology and agriculture. He may be said to have been the founder of modern organic chemistry and its necessary method of analysis. He analyzed many organic acids; discovered chloroform and chloral; he made the theory of the composition of ether and the oxidization of alcohol subjects of new experiments, in the course of which he discovered aldehyde. He determined the basicity of many acids; analyzed the chemical composition of urine and the products of uric acid and made profound inquiries into the juice of flesh and its component substances. He raised chemistry from a position of obscurity and unprofitable hypothesis into its present all-dominating position by his theory of the constitution of alcohol, ether, etc., and his work on the benzoyl compounds is especially remarkable in this connection. The industrial importance of his discoveries is great. Cyanide of potassium is now largely employed in electroplating and in the manufacture of ferrocyanides. His improved method of producing this cyanide has cheapened its manufacture, just as the discovery of aldehyde has led to improved methods in the making of vinegar and looking-glasses. The result of his great discoveries has been especially felt in medicine, agriculture and food-hygiene. His great generalization that the mineral and organic worlds were composed of the same chemical elements and were subject to the same chemical mutations revolutionizing science. He traced for the first time the transformation of inorganic into organic substances in plants, from which they were transferred to the organisms of animals. His exact statement of the elements received by plants from the soil and air enabled him to prescribe the composition of efficient fertilizers and thus, in the treatment and analysis of soils, to raise the fundamental operations of agriculture to the level of exact science. Consult Liebig, ‹The Natural Law of Husbandry› (1863); ‹Animal Chemistry in its Application to Physiology and Pathology› (1846); ‹Handbook of Organic Analysis› (1853); Hoffmann, ‹The Life-Work of Liebig in Experimental and Philosophical Chemistry› (1876). See CHEMISTRY; AGRICULTURE.

LIEBKNECHT, lēp'knĕht, **Karl** (Paul August Ferdinand), German Socialist leader: b. Leipzig, 13 Aug. 1871; d. 15 Jan. 1919. The eldest son of the famous Socialist, Wilhelm Liebknecht (q.v.), he was a lawyer by profession and, since 1912, a member of the Reichstag representing the constitutency wherein the ex-Kaiser resided — Potsdam. A fearless and outspoken critic of the government militarist policy, he came into frequent collisions with the authorities. He earned considerable notoriety by bringing grave charges of corruption against the Krupp firm at Essen, charging it with tampering with petty officials of the German War Office and Admiralty. He was sentenced to 18 months' imprisonment in 1907 for publishing an anti-militaristic pamphlet, and in 1912 attacked the government for permitting the Tsar of Russia to visit Germany. He was the only member of the Reichstag to oppose the war, which he condemned with fiery eloquence from the beginning. Much has been written on the failure of the German Social Democratic party to live up to their principles in supporting the government policy of aggressive war. But it is only just to bear in mind that the storm fell upon the German Socialists as suddenly as upon France and England; they knew less of the causes of that storm than the French or British knew; like those two peoples, they saw that their country was in danger and resolved, as they also did, to subordinate everything to the pressing duty of saving it from ruin. The isolation of Liebknecht, therefore, was more apparent than real. Though he alone uttered his thoughts, they were shared by many of his colleagues. Early in the war he visited Belgium and explained to the Belgian Socialists that, although the vast majority of German Socialists were in favor of fighting the war to the bitter end, there were numerous representatives of the party in the Reichstag who maintained that the misguided foreign policy of their country had been largely responsible for the war. When Liebknecht's father and August Bebel (q.v.) resisted in the Reichstag the proposal in 1870 to annex Alsace-Lorraine, both were thrown into prison. Karl went much further than his father. It was he, who, when the German press was fanning the flame of hatred against the Belgians by stories of atrocities committed against German soldiers, hunted the stories to their source in hospitals and elsewhere, proved them to be baseless and denounced them as such in *Vorwärts*. On 2 Dec. 1914, while those of his fellow Socialists who opposed the war walked out of the Reichstag while the credits were voted, Liebknecht remained to utter his protest. The president would not allow him to speak and when he handed in his speech in writing the president refused to insert it in the records. In that undelivered speech, later published in England, he denounced the war as having been “prepared by the German and Austrian war parties” and wound up with a scathing indictment of the violation of Belgium and Luxemburg. In March 1915 he spoke against the government repudiation of its promise to abolish the property suffrage in Prussia, but the Diet fled at his rising. With the death of Bebel in 1913 Liebknecht became the foremost figure in the most powerful party in Germany, his opinions uncompromising, his honesty unquestioned, his courage equal to any occasion. In June 1916 he was charged with attempted high treason and sentenced to 30 months' imprisonment. He had been expelled from his party five months earlier by a vote of 60 against 25; he was now dismissed from the army, in which he was serving as a private. He was liberated in November 1918. In the same month a volume of his speeches was published in New York entitled ‘The Future belongs to the People.’ Liebknecht led the radical Spartacus group against the Ebert government during the disorders following on the Kaiser's flight. He was arrested and later shot down by a soldier on the alleged grounds of attempting to escape.

LIEBKNECHT, Wilhelm, German Socialist: b. Giessen, 29 March 1826; d. Berlin, 6 Aug. 1890. He studied at the University of Giessen and later at Marburg and Berlin. He was early interested in the writings of St. Simon, and in 1848 went to Paris to take part in the revolution there; then joined in the unsuccessful attempt to make Germany a republic, and was imprisoned nine months without trial. When released he went to Switzerland, where he tried to unite the trade unions on a socialistic basis, was again arrested, handed over to the French authorities and banished to England. While there he became an intimate friend of Marx and Engels (qq.v.) and was a member of the Communist League. In 1862 he returned to Germany, continued his socialistic agitation and in 1865 was banished from Prussia. He went to Leipzig, where he met Bebel (q.v.), was active in trade union organization and was one of the founders of the Saxony Volkspartei soon absorbed by the German Social Democratic party (1868), of which he was from the first a leading member. In 1867 he was candidate for the North German Parliament, but was under arrest and lost the election; he was, however, elected later. In 1868 he was made editor of the *Demokratisches Wochenblatt*, the next year enlarged and published under the name of *Volkstaat*. In 1870 he denounced the Franco-Prussian War, for which he was imprisoned three months, and later so bitterly attacked Bismarck that he was again imprisoned. In 1874 he was elected to the Reichstag of which he was a member almost constantly till his death. He was one of the strongest leaders of his party in that body, and very popular and highly respected among German workingmen. In 1890 the name of the *Volkstaat* was changed to *Vorwärts*, and Liebknecht was retained as editor. He wrote ‘Die Grundund Bodenfrage’ (1874), a discussion of the land question from the Socialist standpoint; ‘Ein Blick in die neue Welt’ (1887), an account of his visit to the United States; ‘Robert Blum und seine Zeit’ (1890); ‘Robert Owen’ (1892), and ‘Socialism, what it is and what it seeks to accomplish’ (translated and published in the United States). Consult Aveling, ‘Wilhelm Liebknecht and the Social Democratic Movement’ (1896).

LIECHTENSTEIN, lēh'tĕn-stīn, a small independent municipality, practically a portion of the Austro-Hungarian monarchy and united with the Austrian Customs-Union since 1866, between Vorarlberg, Tyrol, and Switzerland: area, 65 square miles; population about 10,000

The surface has a fertile soil, yielding abundance of pasture, corn, wine, fruit and flax. The capital, Vaduz, has about 1,000 inhabitants. The reigning family date from the 12th century, and are descendants of free barons who became princes of Liechtenstein in 1608.

LIED VON DER GLOCKE, Das. This poem of Schiller's deals with the casting of a bell from the moment when the mold is completed to the one in which the new bell is lifted from the pit. In 10 stanzas distributed all through the poem the different stages of its making are described. Between these stanzas reflections on and scenes from human life, suggested by certain data in the different stages of the casting, are inserted. Such happy and unhappy events and conditions in the life of the individual and of the community as are usually announced by the ringing of bells are portrayed, e.g., wedding and family life by the wedding bells, revolution by the alarm bells. The whole is spoken by the master bell-founder to his assistants during the work. ‹The Song of the Bell,› composed in 1799, gives better evidence of Schiller's genius than any other of his shorter poems. It is distinguished alike by matter-of-fact accuracy, vivid description, idealism and practical wisdom of life. In form the stanzas dealing with the casting are all of the same fixed structure and constitute the backbone of the poem, while the other portions allowing full sway to the spontaneous flow of conceptions display the most diverse means of versification. On 10 Aug. 1805 Goethe had ‹The Song of the Bell› produced on the stage as a memorial to Schiller (died 9 May 1805), and he himself composed for this occasion his famous poem ‹Epilogue to Schiller's Bell.› Consult edition of Schiller's works in ‹Deutsche National-Literatur› (Vol. I, 1882–98); Schiller's poems selected by J. S. Nollen (1905); special edition by C. P. Otis (1885); English translation in ‹German Classics› (Vol. III).

Ewald Eiserhardt.

LIÈGE, lē-āzh, Belgium, (1) the easternmost province bordering on Rhenish Prussia and the Netherlands. Area, 1,117 miles. The surface is diversified with heights varying from 300 to 2,000 feet and well wooded. It contains rich coal and iron mines. The northern part called Herveland is exceedingly fertile and highly cultivated, affording pasturage for cattle and producing large quantities of butter and Limburg cheese. Pop. about 896,649. (2) An episcopal city and the capital of the province at the confluence of the Ourthe and Meuse, 54 miles southeast of Brussels. The city has been considerably modernized since 1860 by the construction of fine quays and bridges along the course of the Meuse throughout the city. It has numerous striking public buildings including the Gothic cathedral of Saint Paul, the Palais de Justice and the celebrated university, occupying extensive grounds, with special institutes for various sciences, a school of mines, a school of arts and manufactures, and an important library. Liège is one of the largest manufacturing towns of Europe, owing principally to its situation in a district abounding with coal, iron, lead, copper and marble. Cannons and firearms of every description, steam engines and machinery, hardware of every kind, watches, jewelry, bronze and other ornaments, woolens, cottons, etc., are made. Liège dates from the 6th century. Pop. about 170,634, chiefly Roman Catholic. Liège was defended by a girdle of forts, six on the left bank and six on the right bank of the Meuse. At the outbreak of the Great War in August 1914 the town was taken possession by the Germans on 7 August, but the defense of the forts was maintained until after the arrival of heavy and siege artillery, and the German advance was thus delayed for more than a week.

LIEN, lē'ĕn or lēn, a legal claim on or upon property; a legal right in one person to detain the goods of another until some claim of the former against the latter has been satisfied. Blackstone says a lien may be either particular or general; the former where the claim of retainer is made upon the goods themselves, in respect of which the debt arises, a claim which the law favors. The other, or general lien, is where goods are retained in respect of a general balance of account, which is less favored. Though general liens are not favored by law, yet in some cases they have been allowed and established by usage, as in the case of attorneys upon the title-deeds and documents of their clients; and factors, warehousemen and others, upon goods confided to them in the ordinary course of business.

LIEUELY, Greenland. See Godhaven.

LIEUTENANT, lū- or lĕf'tĕn'ạnt, a military term, which, like captain and many others, has acquired gradually a much narrower meaning than it had originally. Its true meaning is a deputy, a substitute, from the French *lieu* (place, post) and *tenant* (holding). A *lieutenant-général du royaume* was a person invested with almost all the powers of the sovereign. Lieutenant-general is the title of the commanding general of each division of an army, personating the general-in-chief. Lieutenant-colonel is the officer between the colonel and major. The term lieutenant by itself, in military language, signifies the officer next below a captain, whether in the cavalry or infantry. There are also second lieutenants ranking below lieutenants. A lieutenant in the United States and British navies is the officer next in rank to the commander of a ship who is next to the captain. He takes rank in both these services with a captain in the army, and after eight years' service he ranks in Britain with a major. In the United States a lieutenant ranking with a major is called lieutenant commander.

LIEUTENANT-COLONEL, a military title, given the officer next in rank to a colonel, and the senior of a major. He assumes command of the regiment only in the event of the disability or temporary absence of the colonel of the regiment.

LIEUTENANT-GENERAL, formerly general officer in the United States army, ranking above a major-general and below a general. The office of lieutenant-general was first created by Congress for George Washington in 1798, during the troubles between the United States and France. It then lapsed till renewed by Congress for Gen. Winfield Scott, who was made lieutenant-general by brevet. In 1864 it was again revived for Gen. U. S. Grant, and continued for Generals Sherman and Sheridan.

The grade was also conferred on Gen. John M. Schofield, 5 Feb. 1895, who held it till his retirement, 29 September following. An act of Congress of 6 June 1900 provided that «the senior major-general of the line commanding the army shall have the rank, pay and allowances of a lieutenant-general»; and on the reorganization of the army in February 1901 the grade was revived and President McKinley appointed Maj.-Gen. Nelson A. Miles its incumbent. In 1903 the rank was again abolished, an act of Congress providing for a general staff, the chief of staff to take the place of the lieutenant-general.

LIEUTENANT-GOVERNOR, an executive office of several of the States, ranking next to the governor. He performs the duties of a governor in case of the latter's death, absence from the State or inability to act, and is presiding officer of the State senate.

LIEZEN-MAYER, lĕ'tsĕn-mī'ĕr, **Alexander,** Hungarian painter: b. Raab, Hungary, 24 Jan. 1839; d. 1898. He studied at Vienna and Munich, attending the art academies in those places and afterward entered the studio of Piloty (1862) in the latter city. Under this master he painted his 'Queen Maria and Elizabeth of Hungary at the Grave of Louis le Grand' and 'The Coronation of Charles of Durazzo in the cathedral of Stuhlweissenburg.' Three years later he carried off the first prize at the Munich Academy exhibition. In 1867 he painted 'Maria Theresa'; 'The Child of a Poor and Sickly Mother'; and as drop-scene for the Munich Theatre, 'Poesy Surrounded by the Muses.' In 1867 he began to paint portraits, and also furnished illustrations for the works of Goethe and Schiller. During a residence in Vienna (1870–72) he executed portraits of the emperor and many of the nobility. On his return to Munich he painted some ideal figures from Shakespeare's 'Cymbeline' and some scenes from Goethe's 'Faust,' and in 1873 'Elizabeth Signing the Death Warrant of Mary Stuart' (in the museum at Cologne), and one of his masterpieces, although its principal merit lies in the perfection of the technique. He produced also many cartoons for woodcut reproduction as illustrations of the poets. For three years he was director of the Art School at Stuttgart (1880–83), when he was appointed professor of historical painting in the Munich Academy.

LIFE. No definition of life has ever proved quite satisfactory. Some include too much, others omit certain phenomena, a third class assumes conditions purely hypothetical, while many are unintelligible. Bichat says that life is «the sum total of the forces that resist death»; Treviranus, that it is «the constant uniformity of phenomena with diversity of external influences»; Duges, that it is «the special activity of organized bodies,» and Beclard, that it is «organization in action.» De Blainville's definition is: «Life is the twofold internal movement of composition and decomposition, at once general and continuous.» But according to Herbert Spencer this conception is in some respects too narrow and in others too wide. Of his own definition, that it is «the co-ordination of actions,» he says—«like the others this definition includes too much, for it may be said of the solar system with its regularly recurring movements and its self-balancing perturbations, that it also exhibits co-ordination of actions.» His amended conception of life is: «the definite combination of heterogeneous changes, both simultaneous and successive, in correspondence with external coexistences, and sequences.» G. H. Lewes suggests the definition: «Life is a series of definite and successive changes, both of structure and composition, which take place within an individual without destroying its identity.» However, this amounts to defining *ignotum per ignotius*. The most recent attempts have been in the direction of proving that life is merely a form of energy or motion, and show the influence which the physical sciences have had in recent years over knowledge and speculation, which formerly were mainly based on biology and theology. The simplest answer to the question probably is: Life is metabolism.

Leaving the subject of attempted definition, it will be profitable to observe some of the characteristics of life as compared with its absence; that is, substantially, a comparison of the organic with the inorganic part of the universe. The boundary between living and not-living matter is much less distinct than rough inspection suggests, but some of the most striking characteristics which distinguish living organisms from other objects of our experience which are not-living may be pointed out. The distinctive properties of living matter are, first, the fact that it is organized; second, that it has the power of perpetuating itself within definite limits by chemically taking and adapting (assimilating) suitable material from the surrounding media, and in the process generating heat (energy) in the absence of which it disappears; and, third, that it has the power of self-reproduction. Life cannot exist without that chemical interchange between the organism and its inorganic environment, and between the constituent parts of the organism which is summed up in the word metabolism (q.v.). Objections have been made to some of the definitions quoted above, and to others, that they assumed the existence of organization. But so far no evidence is present of any living thing without organization. The simplest one-celled animals and plants (see Amœba; Protista) consist of organized protoplasm. This fundamental living substance, called protoplasm (q.v.), is of complicated structure and chemical composition. Its structure differs in different organisms; but it everywhere consists of a combination of viscous «plasma» and water. The plasma contains the chemical substances upon whose changes life depends. Protoplasm is, however, not homogeneous. At least two kinds are found in every mass, the cytoplasm, constituting the major part of the whole; and usually the nucleus, the nutritive and reproductive centre. The combination of cytoplasm and nucleus forms a cell. Combinations of cells constitute the bodies of all organisms, large or small, past or present. These combinations are accumulations resulting from the property, characteristic, regularly and fundamentally, only of living organisms, of the doubling of molecules, by which growth is effected.

The fundamental vital phenomena may be regarded as (1) nutrition and (2) reproduction. The conditions under which these activities may be manifested are narrow in general, and the more closely limited in respect to a particular organism in proportion as its organization is more or less complicated. These conditions belong to the environment, from which the organism must take the elements necessary to its continued repair of loss — in other words, get food. Essential elements are oxygen, water and certain salts; in a word, all the constituent elements of protoplasm, at the least, must be obtainable from the air or water, in order that vitality may persist. It is needful, however, that certain harmful things (poisons) should be absent, or the organism will be killed. Death will also follow excess or deprivation of the proper proportions of the food elements; too much or too little water; a raising or lowering of the temperature above certain points; excess or defect of light, improper electrical conditions, etc. The simplest animals and plants, consisting of little except protoplasm and water, have great power of resistance to untoward conditions, and the range of diversity in circumstances in which they are able to survive is very wide. Life in its higher manifestations is dependent upon the maintenance of a few well-defined conditions, and that innumerable accidents may bring it to a permanent end (see DEATH), whereupon the material which it animated instantly becomes inert matter subject only to the laws that governing the inorganic world.

Reproduction is the means of securing that continuity of life which is one of its primal characteristics, and consists in the separation from the original organism of a part, relatively greater or less in proportion as the organization so divided is simple or complicated, which part is equally endowed with the potentialities of living and reproduction, and normally will reproduce its kind in turn.

For an account of the speculations and reasoning as to the origin of life on the earth, see ORIGIN OF LIFE; PROTISTA; MECHANISM AND VITALISM.

LIFE AND ADVENT UNION. See ADVENTISTS.

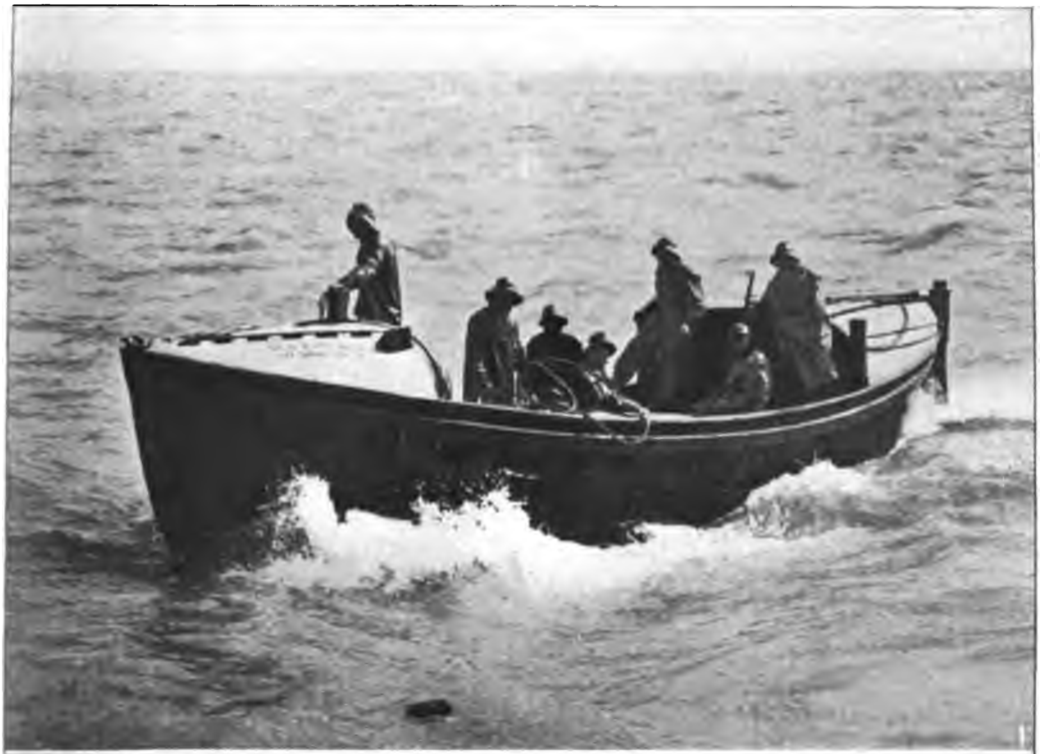
LIFE-BOAT, a specific type of boat designed especially for saving the lives of persons on ships wrecked near a shore. It must be constructed with strength sufficient to resist violent shocks from the waves, the rocky beach or collision with the wreck; be buoyant enough to avoid foundering, and to float though loaded with men and filled with water; have facility in turning, and when capsized be able to right itself. Such boats are now maintained at most of the life-saving stations in America and Europe, ready to put to sea at once if their services are required, and provided with the means of being conveyed to the beach and launched with all possible rapidity. The first distinctive lifeboat was designed by Lionel Lukin, an English coach-builder, in 1785. He called his boat an «immergible» and gave it the desired non-capsizable qualities by affixing to the frame a thick projecting gunwale of cork. He also provided watertight air-chambers at the bow and stern, and along each side, and ballasted it with a heavy iron keel. Following him, William Wouldhave and Henry Greathead simultaneously invented a boat on the curved-keel principle — in general shape very like a sixth part cut lengthwise from a longish musk-melon. This provided a self-righting model, but that idea alone did not prove altogether successful in practice, and many cubic feet of cork were built into the two boats. Greathead's model was accepted officially and several of his boats were put in use and saved many lives. Till 1851 Greathead's invention was almost the sole one in use, though numerous others had been either introduced or proposed; but in that year no fewer than 50 models of improved lifeboats were sent to the London Exhibition in competition for a prize offered by the Duke of Northumberland for improved construction. The prize was won by James Beeching, a practical English boat-builder, with a boat that was self-righting when capsized and self-bailing when water entered. The model utilized the principle of water-ballasting. James Peake of Woolwich Dockyard, by combining the excellencies of the competing boats, and adding others suggested by his own experience, designed a boat which, gradually improved from time to time, became the recognized model, and has been adopted as the standard for lifeboats in all countries. This lifeboat possesses great lateral stability or resistance to upsetting; speed against a heavy sea; facility for launching and taking the shore; immediate self-discharge of any water breaking into it; strength; stowage-room for a large number of passengers. The great breadth of beam (eight feet) in proportion to her length (33 feet) is to diminish the liability to capsize in a heavy sea. The relieving-tubes, by which any water that breaks into the boat is immediately self-discharged, are most ingeniously contrived. The self-righting characteristic, at first considered of prime importance, was soon found to militate against other qualities more desirable, and while the self-righting principle is applied to the small surf boats, the lifeboat is now made very difficult to capsize, and the crew are specially drilled in the process of righting the boat if by any rare accident it should be overturned. Such are the precautions for the safety of the crew in these English boats that loss of life in the conduct of the boat is of rare occurrence. Some are made with two centreboards for greater stability. The lifeboat transporting carriage or truck is an important auxiliary to the boat. The lifeboat is kept on this carriage in the boat-house ready for immediate transportation to the spot most favorable for launching to the wreck. In this way a greater extent of coast can secure the benefits of the lifeboat than could otherwise be the case. Even when the launch is from the immediate vicinity of the boat-house the use of the carriage saves much time, which in a case of shipwreck may prove of vital importance. Besides, a boat can be readily launched from a carriage through a high surf, when without a carriage she could not be got off the beach. The machine is admirably contrived, and the boat may be launched from it in an upright position with her crew on board. To render it more manageable and of the greatest possible utility the fore and main bodies can be detached from each other by the withdrawal of a forelock pin. The British Life-Saving Institution now maintains a fleet of about 300 lifeboats at stations along the English coast, and expends about $600,000 a year in their maintenance. In the 94 years up to 1917 they had saved more than

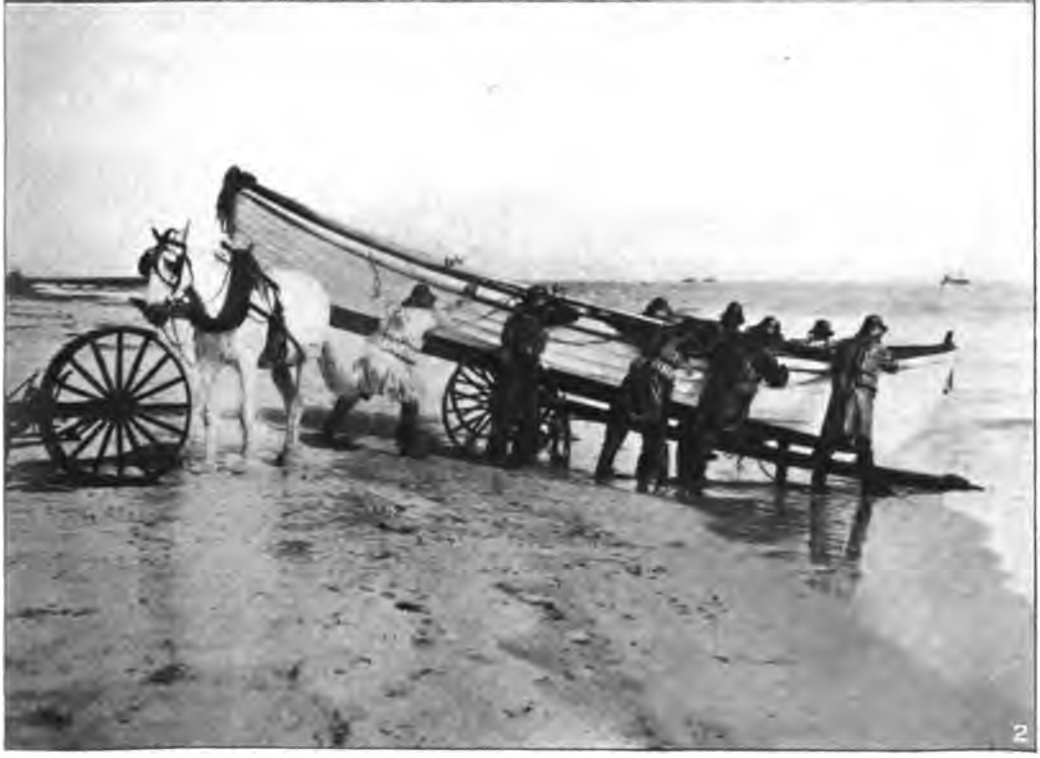
50,000 lives. Since 1890 the institution has been introducing steel lifeboats, 50 feet in length and of 20 beam, with steam engine power and propellers operated on a turbine principle. A little later the motor-boat type was introduced and is now preferred to the steam-propelled lifeboats. Practically all European countries maintain coast life-saving stations equipped with lifeboats and other apparatus, but in India, Australia, New Zealand and Japan these services are maintained by voluntary associations.

American Lifeboats.— These were originally patterned on English models, but through a system of steady improvement have developed along slightly different lines, and now exhibit distinct types. The earlier boats used air-compartments fore and aft, and sometimes along the sides or under the seats. It was more common, however, to stow the lines, grapnel-ropes, etc., under the seats. The whaleboat type of rowboat was preferred, owing to its strength; they were built quite broad of beam, and high at the ends, so as to bring the air-chambers above the water-line as much as possible. At first tanks were built of galvanized iron, but copper was found much more serviceable, and gradually it has become customary to cut up the tanks into an increasing number of compartments, so that late models comprise a series of copper boxes, fitting into their places in the hull. The ship's lifeboat pattern disappeared from land use, and they became differentiated into surf-boats and power-boats. The surf-boat is based on the fishermen's boats that are shaped to come readily through the surf, and that can be landed with little danger of overturning. The typical American surf-boat of the Coast Guard is of the Beebe-McLellan type, 26 feet over all, 7 feet beam and 2½ feet deep. It carries four oars, is clinker-built, of cedar, sharp at both ends, gracefully curved, very light and strong. There are three thwarts, seats around the sides, a centreboard and a place for stepping a mast. A water-tight deck is placed high up in the framing, so that when the boat capsizes the water can be led off by gravity, being thus what is termed «self-bailing.» It is so buoyant that it can be upset and righted in 20 seconds by a crew on drill. Lines are rigged especially so that the crew can grasp them when in the water and obtain a leverage for righting the boat. More and more of these surf-boats are being equipped with gasoline motors. At first eight horse-power motors were installed, but now they are always 12 horse-power and higher power is under consideration. Some special types of surf-boats have been built for localities, after which they are named, as the Jersey and Race Points surf-boats. Power lifeboats are increasing in number and every good-sized station now has at least one. The typical power-boat is 36 feet in length by nearly 9 feet beam and 4¼ feet in depth. There are five thwarts or seats and steps for two short masts. The upper part of the deck is arranged to be self-bailing, and there are large air-compartments fore and aft, and a great number of small copper compartments stowed wherever there is space for them. The gasoline motor, usually 35 horse power, is carried in the water-tight after bulkhead, and so arranged that if the boat overturns the engine is automatically stopped. The starting crank and reversing clutch are set in the bulkhead, out of the way and safe from accident. The twin engine shafts run at a slightly inclined angle down to the propellers, which are quite small and above the keel-line. Often the propeller shafts are hinged, so that the propellers may be raised when the boat is to be beached. The keel is made preferably of gun-metal. The rudder is ham-shaped. The gasoline tanks are forward near the centreboard, which is of brass in the best boats. A speed of 10 to 12 miles an hour is obtained. These boats are designed to be loaded on a beach-wagon at a life-saving station, and as they weigh only 3,000 pounds can be easily launched with less than the full crew of eight men. A smaller type of power-boat is built, 34 feet over all and 8.4 feet beam, 3.6 depth, with 5 thwarts. These were mostly designed for sail or oar propulsion, but have been fitted with 25 horse-power motors, giving a speed of seven to nine miles an hour. The Revenue Service and Life-Saving Service having been combined in 1915, under the title of the Coast Guard, all the lifeboats of the two United States coasts and the Great Lakes are in their custody, divided among the 270 stations. There are about 50 of the best class of 36-foot power-boats, and some 200 second-class power-boats, perhaps 300 surf-boats and a number of smaller rowboats for various purposes. The larger fleet in the Coast Guard service, sometimes referred to as lifeboats, consists of 23 cruising cutters, mostly steel boats from 150 to 210 feet. These cutters are armed with four six-pounders and carry rockets and radio apparatus. In cruising off coast they discover and help many vessels in distress, and if near enough may summon the lifeboats of some station by S O S calls. There are also 24 harbor cutters and launches under the Coast Guard's jurisdiction, used mostly in the important harbors for dealing with accidents to pleasure boats, assisting in putting out fires on the water-fronts and the like. There is rarely a day that the Coast Guard does not rescue some vessel somewhere in trouble, and perhaps five a day is a fair average, while in bad weather sometimes 12 and 15 rescues are recorded in a single day. In 1916 they rescued 2,153 persons from peril, rendered assistance to 1,594 vessels, removed or destroyed 11 derelicts, and a lot of miscellaneous work that the revenue service and the navy puts upon them for convenience.

Steamship Lifeboat Requirements.— The United States Steamboat Inspection Service has control over the lifeboat regulations in all classes of vessels in United States waters. Their rulings require pleasure steamers on short routes to carry one lifeboat to every 180 cubic feet of capacity. Ocean steamships and miscellaneous passenger carrying steamers are obliged to carry enough boats and life-rafts combined to accommodate all their passengers in case of need. Many of their lifeboats are collapsible affairs with cork floats or compartments designed to be blown up and filled with air before they can float. Coastwise steamships, in the summer-time, are allowed to carry some excess of passengers above their lifeboat capacity, and two-thirds of their equipment may be life-rafts or collapsible equipment. Lake, bay and sound steamers, and others going over shallow waters not over five miles from land,

LIFEBOATS





From Annual Report (1916) United States Coast Guard

1 Typical Power Lifeboat. Crew of the Chicago Coast Guard Station returning from a rescue
2 Preparing to launch surfboat

are permitted to carry lifeboat equipment for only 10 per cent of their passenger capacity, including crew; but if they go beyond five miles from land they are required to carry 30 per cent equipment. Of this three-fourths may be collapsible. Only 10 per cent equipment is required of ordinary river steamers. Consult Cameron, 'The Life-Boat and Its Work' (London 1911); Haydon, A. L., 'The Book of the Lifeboat' (London 1909); Sawman, 'The Life-Boat' (Brooklyn 1912); 'Annual Reports United States Coast Guard' (Washington, D. C.).

LIFE-BUOYS. See Life-preservers.

LIFE IS A DREAM ('La vida es sueño). Calderon's 'Life is a Dream' was written about 1635 and published in 1636. The play was probably composed for the theatre of the Royal Palace at Madrid. In grandeur of conception, if not in style and execution, it is one of the masterpieces of Spanish dramatic literature. To develop the theme that «life is such stuff as dreams are made of,» and that this transitory life is but a preparation for the real life of the next world, Calderon adapted to his purpose a story told of Philip, Duke of Burgundy, but of Oriental origin. The jest of bewildering a drunken man found in a market place into the idea that he is a duke, who, upon meditating on the princely life he has led for a day, is uncertain whether it has been reality or a dream, was also used by Shakespeare, but for comic effect, in the induction to the 'The Taming of the Shrew.' Not content with one theme, Calderon wove into his play another, suggested to him by the story of Barlaam and Josaphat, likewise of Oriental origin, which he found in one of the many lives of the saints and in Lope de Vega's play, 'Barlán y Josafá,' 1611. This story of a prince who is brought up in a prison in order to forestall the predictions of astrologers was used by Calderon to illustrate the doctrine of free will, a subject hotly debated at the time in Spanish universities. Finally, as all Spanish plays had a love element, and ended happily in the marriage of all the characters, the dramatist added a further complication,— love intrigue. This element of his play Calderon treated as an unwilling concession to the taste of the time, interlarding the dialogue devoted to it with hackneyed quibbling about honor, and the conventional, euphuistic verbiage so popular in comedies of the 17th century. The main themes he developed with great simplicity of diction, and a wealth of fine lyrical passages which atone for the blemishes just noted. Chief of these lyrical outbursts is the soliloquy of Segismundo, «Ah, woe is me . . .» (ll. 102–172), in which the physical limitations and Promethean promptings of an imprisoned soul are contrasted with the freedom of birds that fly at will and of «fishes that tipple in the deep.» This monologue, like many another fine passage in Calderon's works, was not original with the author, but was a mosaic of words and imagery borrowed from other writers. Almost as famous are the closing lines of the second act, in which Segismundo expresses his disillusionment. «What,» he asks, «is life? An illusion, a shadow, fiction, and the greatest good is small, for all life is a dream, and dreams are dreams.» Such a pessimistic, non-Christian conception of life, the poet makes haste to correct in the last act (ll. 2359–2371, 2423–2427). There too he defines his conception of free will: «No mortal can forestall the decrees of fate (predestination), but the wise man can so prepare himself by prudence, moderation and humility that he is fortified against its blows.» (ll. 3215–3227).

The strength of the play lies in its grandiose conception and its lyrical passages. The defects are equally conspicuous. Chief of these is the failure — common to most Spanish plays of the 17th century — to develop the character of the protagonist. The transition from a savage state, in which Segismundo is a Caliban without knowledge of the world; his titanism and eagerness to rule and impose his will on everybody when brought to the palace; his disillusionment upon realizing that life is only a dream, and the final conviction that if life is only a dream, truth is eternal, and that he must curb his passions, as the safest procedure against the time when he may awake — all these transitions are abrupt and unconvincing, and mar one of the world's masterpieces. Consult the edition by Buchanan (Toronto 1909); 'La Vita è un Sogno,' Farinelli (Torino 1916); the translation in the metre of the original by D. F. McCarthy in 'Calderon's Dramas' (London 1875), and the adaptation by Edward Fitzgerald, 'Letters and Literary Remains' (London and New York 1889).

Milton A. Buchanan.

LIFE-ESTATE, in the common law, as applied in England and the United States, a freehold not of inheritance; an estate or interest in real property for a life, and which is either conventional or legal. A conventional life-estate is expressly created by the act of the parties, and is for the life of the owner, or for the life of another, in which case it is called an estate *pour autre vie*. A legal life-estate is either tenancy-in-tail after possibility of issue extinct; or what in the older country is technically designated courtesy of England, that is, the life-interest held by a husband in his wife's fee-simple or fee-tail estates, general or special, after her death; or dower, that is, the right which a wife has for her life in the third part of the lands and tenements held in fee-simple, fee-tail-general or as heir in special tail by her husband at the time of his decease. The tenant for life may cut wood to repair fences and for household fuel. If there is an open mine on the estate he may work it for his own profit, but he cannot open one. See Estate; Fee Simple; Enfeoffment; Forfeiture.

LIFE-EVERLASTING, one of the everlasting (*Anaphalis margaritacea*), called the pearly or large flowered; also silver-leaf, cottonweed, none-so-pretty, etc. See Everlasting.

LIFE EXTENSION. Among the many facts which have been revealed by the investigations of scientific shop management none has proved more startling than the disclosure of the economic waste involved in the sickness and premature death of skilled workers in all industries. While it may, at first thought, seem contrary to the spirit of modern industrial management to speak of men as «machines,» those who are most interested in the promotion of the principles of sickness prevention and life extension insist that it is necessary that this view should be taken if one is to fully comprehend the fact that the human body is a great laboratory which transforms food into the energy that industry requires in its work of production. As Dr. F. C. Wells said, in an address before the Executive's Club of New York: «We should look upon the men at work in the shops and stores as human machines—marvelous human machines, yet still machines. It is tremendously important to you as employers that these human machines are working properly. . . . We often hear it said that a man has died a sudden death. This is a mistake. This apparently sudden death is merely the end of a long-preceding process of decay, and this decay, which is during every working day attacking some of your men, ought to be detected so that, as with a turning lathe, the proper methods of upkeep may be provided. Each machine has what may be called its normal load, under which it works without strain. With men, too, it is not unusual for strains to be so serious that they crumble up. The machine is working poorly. You cannot tell how much work a man should do unless you give him a physical examination. The amount of work which he does, and which anybody can see, is no proper test.»

This is the principle back of life extension work in industry. How badly such activities are needed was shown by the investigations of the Metropolitan Life Insurance Company, under whose direction seven community surveys were made, in widely separated localities, to determine the extent of sickness, especially among the wage-earning population. The percentages of those sick as well as the percentages of those who were so sick as to be unable to work are given in the following table:

		Percentages	
COMMUNITY	Survey made	Sick	Unable to work
Rochester, N. Y.	September 1915	2.31	1.92
Trenton, N. J.	October 1915	2.55	1.98
State of North Carolina	April 1916	2.85	2.29
Boston, Mass.	July 1916	1.96	1.80
Chelsea Section, New York City	April 1917	1.48	1.38
Cities in Pennsylvania and West Virginia (white and colored)	March 1917	1.96	1.85
Cities in Pennsylvania and West Virginia (colored)	March 1917	2.31	2.18
Cities in Pennsylvania (white)	March 1917	1.75	1.65
Cities in West Virginia (white)	March 1917	3.30	3.11
Pittsburgh, Pa. (white)	March 1917	1.62	1.55
Kansas City, Mo.	April 1917	2.52	2.39
Average, all surveys		2.02	1.88

While comprehensive figures as to the extent of sickness throughout the United States are not obtainable, the surveys of the Metropolitan Life Insurance Company are illuminative, for they also show that the average loss for the 376,573 persons covered by these investigations was 8.4 days per year, or 6.9 working days, and if the same ratio applies to the entire industrial population of the country, it can easily be estimated that the annual wage loss through sickness for 40,000,000 workers would be in excess of $500,000,000.

Although there are no figures on which even estimates of the loss due to premature death from preventable disease can be based, the United States army statistics disclose conditions which must exert an important effect upon the earning capacity of the individual and, naturally and inevitably, upon national efficiency. Such are the facts relating to individual defects and disabilities which not only impair the productive capacity of the worker thus afflicted but which later result in disabling disease and death. For example, of the 2,500,000 men between the ages of 21 and 31 years who were examined for military service in 1917, approximately 33 per cent were rejected because physically unfit, while a more particular study of the reasons for rejection shows the prominence of such disabilities as defective hearing, impaired vision, decayed teeth, heart affections, defects of the nose and throat, flatfoot, etc., not to mention the more serious organic ills, all disabilities that are certain to constitute a handicap to the victim in any line of work that he may pursue, for all are physical defects that would in all probability have an effect upon the worker's capacity for production. Even in cases where the disabilities do not result in extended absence from work, it is obviously impossible to expect anything like maximum efficiency from a working force, 25 per cent of whom are suffering from disorders or deformities of the eyes, nose, heart, lungs or other organs.

Modern industrial management is endeavoring to meet these conditions by insisting that all employees submit themselves to a thorough physical examination, not only at the time of employment but at subsequent periods, with a view to seeing that those who are found to be suffering from preventable defects shall receive proper medical or surgical treatment and so be restored to the highest position in the ranks of the wage-earner that it is possible for them to attain.

In the beginning the workers have often been suspicious of the physical examination on the ground that it is designed to afford a means of detecting the less desirable operatives with a view to discharging them but this is a fear that is soon overcome. Following the examination, the results are gone over in detail with the man and, where medical, dental or surgical treatment is deemed necessary, he is advised concerning it, and, not infrequently, he is given substantial aid in carrying out the directions of the examiner. If the examination shows that the worker is suffering from a disability that unfits him for the particular task in which he is engaged and remedial treatment promises small results, as in affections of the heart, he is assigned to a job which he can hold with less danger and with higher possibilities of efficient service.

The question of sickness prevention and life extension was considered a matter of such great importance to the nation that the National Industrial Conference Board made a special investigation of the subject and, in May 1918, its findings and recommendations were published in 'Research Report No. 6.' It declared that existing «conditions call for a vigorous policy of remedial action»; and continued: «. . . all sickness and disability which can reasonably be prevented should be prevented instead of being allowed to remain unremedied until they impose a burden of misery and poverty on the individual and a burden of cost on society.

«Preventive work in the case of such communicable diseases as typhoid fever, tuberculosis, pneumonia and diphtheria has been brilliantly successful. . . . The results already achieved . . . through local effort with limited funds establish beyond a doubt the urgent need of a thoroughgoing investigation of its further possibilities under a definite national policy. . . . Periodic physical examination, not only of industrial workers but of the entire population is another important matter for consideration.

«First a national study of prevailing disease and its causes; then a national program for the prevention of all preventable sickness, with liberal but intelligent provisions for unpreventable sickness, through compensation or otherwise, as a duty of society to its members: — this is submitted as a rational, constructive and humane program for dealing with the sickness problem in its individual as well as its social and industrial aspects.»

In many manufacturing plants and commercial houses where no regular examining physician is a member of the staff, this service in prevention of disease is obtained through one of the commercial agencies engaged in such work.

John R. Meader,
Labor and Service Department, Brighton Mills, Passaic, N. J.

LIFE INSURANCE. See Insurance, Life.

LIFE INSURANCE, Commercial. See Commercial Life Insurance.

LIFE INSURANCE STATISTICS. See Insurance, Life, Statistics.

LIFE OF JESUS, The ('Vie de Jésus,' 1863), by Renan, is the effort of an Oriental scholar and Biblical critic, who was also a subtle psychologist, to disengage the Gospel narratives from what he believed to be legendary accretions and to show the «incomparable man» Jesus «not as a founder of dogmas, a maker of symbols, but as the initiator of a new spirit» who, indeed, founded «the true religion,» for those who came after to develop and make fertile. (13th ed., pp. 460, 461). The book was begun in Syria in 1860 at the suggestion of his sister Henriette, to whom it is dedicated, with the New Testament and Josephus for his only library. It is saturated with the atmosphere of the East; it reveals intimate knowledge of the Bible, of theological speculation, of Syria and of the Syrians; but its method of dealing with documents is more eclectic than scholarly. For Renan the miraculous does not exist because it cannot (pp. 5, 9). All that is certain in the life of Jesus, he says, can be told in a few lines (p. 16). His concern is with the thoughts and feelings of the time, its hopes, its expectations and how the idea of the kingdom of God germinated in Galilee and found its fruition in Jerusalem. Published 23 June 1863, the book immediately evoked wide attention. By November 60,000 copies had been sold; in Renan's lifetime 300,000. It evoked many protests and answers, notable among them Tulloch's, 'The Christ of the Gospels' and 'The Christ of Modern Criticism' (1864). Consult P. Schaff and N. Roussel, 'The Romance of M. Renan and The Christ of the Gospels'; and R. H. Hutton's 'M. Renan's Christ,' in his 'Theological Essays' (1902). There are translations by W. G. Hutchinson and others.

Benjamin W. Wells.

LIFE-MORTARS. See Life-rockets.

LIFE-PRESERVERS are inventions for the preservation of life in cases of shipwreck. In the mercantile marine and passenger ships there are now life-belts for every passenger and every member of the crew. Buoys are carried on the bridge and at the stern of most ships in the mercantile marine. Sometimes the handiest life-buoy is an empty water-cask, well bunged up and with ropes around it to hold on by. There are various kinds of buoyant pillows, life-jackets of india-rubber cloth and mattresses. The cork-mattress can float three men in an upright position.

The life-belt commonly used was designed by Admiral Ward of England. It is made of cork covered with canvas and is both strong and buoyant. It has four separate compartments, so that if one is punctured and bursts, the belt's buoyant power is not entirely destroyed. Each life-belt must have sufficient extra buoyancy to support a man heavily clothed, with his head and shoulders above the water, and to enable him to support another person besides himself. It must be flexible in order to fit tightly to the wearer. There is a division between the upper and lower parts so that it can be securely fastened round the waist and will not impede breathing or the muscular action of the chest or arms. See Lifeboat; Life-rafts.

LIFE-RAFTS are various floating apparatus for saving life in case of shipwreck. The primitive ones are merely square frames buoyed up by a cask at each corner. Empty water-casks well bunged up are very ready and effective instruments of safety in shipwreck and should have ropes attached to them to hold on by. Frames of bamboo and inflated skins have long been in use as life-preservers among different nations, and contrivances more or less ingenious to preserve the buoyancy of the body in case of accidental immersion in water are resorted to in all countries. Whatever is lighter than water, if used on account of its buoyancy as a means of personal safety, may be considered a life-raft. A life-raft invented in England in 1870 is triangular in shape and constructed of wood, cork and rope-netting. It has the advantage of being handy and could be easily hauled to and fro between a ship in danger and the shore. The typical modern life-raft consists of two metal cylinders, usually cone-shaped on the ends, with a frame-work built between them. Owing to the large amount of air space in the cylinders, these have great supporting capacity and will carry all the people who can climb on to or hang on them when in the water. Steamships prefer them to lifeboats because they can be stored in less space on board ship. Their character is regulated by the United States Steamboat Inspection Service, and those for lake and river steamers must have three and one-half cubic feet of air space to each person accommodated. For ocean steamships four and one-half feet must be provided. Another and less popular form of life-raft consists of a copper compartment tube in the form of an O, this being covered with cork and protected with canvas. A platform of slats and lines, oars, etc., complete the equipment. Steamers are usually permitted to use rafts instead of boats for half or two-thirds of their life-saving equipment.

LIFE-ROCKETS are cylinders of metal carrying a small projectile in front and an explosive mixture in the rear for propulsion and are so framed because used to communicate between a distressed ship and the shore. These are especially useful where no lifeboat can be had, or where it cannot be used on account of the roughness of the sea. They are available, however, only at moderate distances from the shore. By means of them a rope is thrown either from the ship to the shore, or from the shore to the ship, generally the latter, and when communication is thus established a slinging apparatus may bring the crew ashore one by one. Of the primitive projectiles for life-preserving purposes, one of the simplest is the heaving-stick, which can be discharged by hand, but cannot be relied on for distances greater than 50 yards. A piece of stout cane two feet long, one end loaded with two pounds of lead and the other attached to a thin line, is whirled vertically twice or thrice, and then discharged. Kites have been tried, but cannot be relied on with certainty. The first trial of the explosive rocket is believed to have been in 1791 by Sergeant Bell, of the English artillery, who fired his projectile from the ship to the shore, but it was soon perceived that it was better to fire from the shore to the ship. John Dennett, of Newport, Isle of Wight, is believed to have been the first to use rockets with success. His faking box for paying out the line is still utilized. The rocket is fired in the same way as a signal rocket, but has a light cord attached designed to fall across the ship. This is hauled in by the crew and brings a start rope strong enough to carry a breeches-buoy (q.v.). A light mortar or gun firing a projectile is now generally preferred to the life-rocket. See LIFE-SAVING SERVICE.

LIFE-SAVING GUNS. See LIFE-ROCKETS.

LIFE-SAVING SERVICE, The United States, for many years an important and effective branch of the public service, under the direction of the Treasury Department, lost its distinct individuality on 28 Jan. 1915, when it was merged with the Revenue Cutter Service to form the Coast Guard. The system was inaugurated in 1871, by Sumner I. Kimball, then chief of the Revenue Cutter Service. In June 1878, by act of Congress, it was organized into a separate bureau. The service covered the coasts of the Atlantic and Pacific, the Gulf of Mexico and the Great Lakes.

The first life-saving stations in the United States were established by the Massachusetts Humane Society at Lovell's Island and Cohasset. All efforts for saving life and property in cases of shipwreck were made by this society till 1837, when the President of the United States was authorized to employ ships to cruise along the shores and render assistance to distressed navigators. William A. Newell, afterward governor of New Jersey, witnessed a fearful shipwreck off Barnegat Island in which many bodies were washed ashore, and was so impressed by the sight that when he was elected to Congress in 1848 he introduced a bill for the relief of shipwrecked persons. The result of the passage of this bill was the placing of a few life-saving stations between Sandy Hook and Little Egg Harbor, N. J., and a little later a few stations were established on the coast of Long Island. Volunteer crews were depended upon at all the stations until the introduction of government organization and control.

The last report issued by the Life-Saving Service under that title is for the year ended 30 June 1914. In that year aid was given to 1,937 vessels, having on board 9,296 persons, whose lives were in more or less danger. Of the whole number 82 vessels were totally lost, and with them 38 lives. The property loss, including vessels and cargoes, was $2,724,660. The value of the vessels and cargoes saved amounted to $18,783,000. The number of lives actually saved, of persons brought to shore, and of those who were removed to places of safety — as in the Texas flood rescues — numbered 4,762. Succor was given to 920 persons for an aggregate of 1,234 days at the stations. The work was carried on from 285 stations, 203 being on the Atlantic and Gulf coasts, 68 on the Great Lakes and 19 on the Pacific coast.

The figures for the remaining seven months of existence of the Life Saving Service were incorporated with those of the new Coast Guard in its first annual report. With the passing of this notable organization into history it is appropriate to present a summary of its accomplishments from its initiation in 1871 to the close of its last official season. The records show that in the 33 years aid was given to 28,121 vessels on which were 178,741 persons in danger. The total number of lives lost was 1,455, attributable in many instances to the great distance from stations at which disasters took place. The total value of vessels and cargoes in the cases in which aid was given amounted to $355,401,084, of which a value of $288,871,237 was saved.

Besides the usual official activities of the Life Saving Service many instances are on record of aid given in other ways. The crews at the stations aided in extinguishing fires along shore; captured burglars; rescued lost property — among which are mentioned aeroplanes and balloons, automobiles, fishing nets, domestic animals and small boats; resuscitated persons near death by drowning; supplied pilots in dangerous waters; replenished failing supplies of water, provisions and fuel to vessels in need; and cared for sick and injured boatmen and sailors.

In the reorganization of the service the personnel has been increased and the life-saving work goes on much as before. But, whereas the duties formerly were along shore exclusively, they now cover also the open seas, wherever the revenue cutters go. See COAST GUARD.

LIFFEY, lĭf'ĭ, Ireland, a river which rises in Wicklow County, flows west into Kildare, then turns northeast and passes through the county and city of Dublin into the Irish Sea after a course of 50 miles.

LIFT BRIDGES. See BRIDGES, LIFT.

LIGAMENT, in anatomy, human and comparative, a band of white fibrous tissue which connects bones. To this class of tissue also belongs the tendons or sinews of muscles, by which these structures are attached to the surfaces of bones. Ligaments differ from tendons in being of a stouter structure, and less liable to give way or to be ruptured. When ligaments break during life they seldom snap across or transversely, but generally tear in an irregular manner. Tendons, on the contrary, when subjected to great strains, break across. Ligaments possess little or no elasticity, and when stretched do not recover. To the same class of structures as ligaments and tendons, the fasciæ or sheet-like bands of white fibrous tissue spread over muscles and regions also belong. Microscopically examined, both ligament and allied structures exhibit sets of fibres arranged in parallel bundles, embedded among which little nucleated bodies known as connective-tissue corpuscles are seen. These latter are minute corpuscles of various shapes, and their function has been assumed to be that of ministering to the growth and nutrition of the fibres amidst which they are placed.

LIGAO, lē-gä'ō, Philippines, a town of the province of Albay, Luzon, situated near the Inaya River, 22 miles northwest of Albay, the provincial capital, on the main road. It is in one of the best hemp growing regions in the archipelago. Pop. 17,900.

LIGATURE, in surgery, a cord, thread, bandage, etc., by means of which structures are tied or bound. A ligature is used for tying a bleeding artery or other vessel; for tying the pedicle of a tumor to prevent effusion of blood or other fluid after its removal. It may be tightly fastened around the base of a tumor to cause its subsequent removal by arrest of its blood-supply and consequent death. Thread of silk or hemp was formerly employed. Ligatures of animal material are now mostly used such as catgut, silkworm gut, etc., also those of silver wire, which are usually rendered antiseptic by steeping in carbolic acid or other antiseptic solution.

LIGATURE. See MONOGRAM.

LIGHT. The word light is used in two distinct senses, namely, to designate the sensation which is characteristic of the organ of vision (q.v.), and also as a name for the usual cause of that sensation. This double meaning of the word would result in little inconvenience if there were always a definite relation between the sensation and its cause; but this is far from being true. For example, when we speak of white light, we may mean a sensation which is perfectly definite and familiar to all persons of normal vision, or we may mean that form of energy which can give rise to such a sensation. In this second sense the term is wholly indefinite, since there is an infinite variety of forms of energy which may give rise to the sensation of whiteness. The difficulty, which is a serious one in scientific language, may be avoided by restricting the use of the word to one of its significations, preferably to that of sensation, after the analogy of the use of the word sound. But such a restriction would not be in accordance with well-established usage, and it would necessitate the frequent employment of awkward circumlocutions. Another means of avoiding confusion is to so divide the subjects treated that the sense in which the word is used is unmistakable. This second method has the advantage of conciseness as well as that of being in accordance with the usage of most writers. The present article treats of light as a phenomenon of wave motion, wholly independent of the sense organ which betrays its existence to us. In it the eye is regarded as a simple optical instrument, quite like the photographic camera. This limitation admits of a satisfactory definition of the terms "white light," "yellow light," etc. Thus, by the former term we mean such waves as are emitted by a solid body at a very high temperature, as, for example, the incandescent lime in the lime-light. Any other kinds of waves, even if indistinguishable from these by the unassisted eye, are not white light. Again, yellow light, green light, etc., are the simplest waves which excite in a normal retina the sensations yellow, green, etc.

Theories Concerning the Nature of Light. —It is now a little more than two centuries since the Dutch philosopher, Huyghens, published a paper in which he explained the familiar phenomena of light by waves in a medium that pervades all space and is called the luminiferous ether. His reasoning was so convincing, the explanations so simple, and the experiments supporting his views so apt, that except for the labors of the single philosopher then living who was greater than Huyghens himself, they could hardly have failed to receive at an early day the universal acceptance which they now command. Nine years earlier, in 1669, Newton had commenced his labors in the field of optics, by which, largely on account of fame and authority won in the domain of mechanics and astronomy, he established a theory of light which remained almost unquestioned for nearly a century and a half. Newton supposed light to consist in extremely small particles of matter projected from shining bodies with enormous velocities. We now know that this hypothesis was not only less fruitful than that of Huyghens, but, even within the comparatively limited range of optical phenomena known to Newton and his contemporaries, was also less probable.

According to this view of Newton, visual sensations are produced by the impact upon the retina of minute corpuscles emitted from luminous bodies which pass freely through transparent substances, differences of color, being due to differing size in these small bodies. When these corpuscles approach the boundary of an optically denser medium they are subjected to a force of attraction which causes them to deviate from their otherwise rectilinear paths. This is the explanation of the phenomenon of refraction. The secondary phenomenon of dispersion was very simple and naturally explained by an assumption that this attracting force varies with differing size. Singularly enough, the explanation of one of the most common phenomena, that of partial reflection at the boundary of a transparent medium, offered formidable difficulties: How is an attraction which is necessary to account for refraction also to act as an apparent repulsion for those corpuscles which are thrown back from the surface in reflection? This is a difficulty which the advocates of the Newtonian theory have never been able to meet in a satisfactory manner.

Wren-Newton attempted to extend his theory to the explanation of the colors of thin plates, a subject which he was the first to investigate in a scientific manner, it was found even less satisfactory. He was obliged to supplement it with the highly artificial hypothesis that the corpuscles experience periodic changes in the ease with which they enter a refracting body. Even this addition to the theory fails to yield more than a rough approximation to an explanation of the phenomena, since the blackness of the central spot in Newton's rings apparatus, when the plates are brought into contact, is in contradiction with it. But it was only on account of a subsequently accumulated knowledge of optical phenomena which refused to adjust themselves to this theory, no matter how it might be modified, that its final overthrow came about. This not only required a long time, but also a champion of transcendent power to break with a system which had the force of tradition as well as the authority of the greatest of all philosophers to support it.

From 1704, the date of the publication of Newton's 'Optics,' until 1815, the corpuscular theory was hardly questioned; at any rate, it reigned supreme in all treatises on light, and it was questioned only by a very few investigators who failed to acquire an influence that was anywhere decisive. In the latter year Augustin Fresnel, a young French government engineer, entered upon a career of scientific activity which proved of almost unprecedented brilliancy and success. This, as far as it bears upon the purely physical theory of light, may be regarded as completed in 1826. Beginning with a highly philosophical criticism of some of the accepted doctrines of optics, supported by the most apt appeals to ingenious experiments, he quickly extended his investigations until he embraced nearly all phenomena of light known to his contemporaries; and this with such success th t he not only established as beyond question the essential truth of a wave theory but brought it to so high a degree of completion that his views were long supposed to be practically final. On account of the importance of this work of Fresnel in the history of physical science of the past century, it is well worth while to briefly review its character.

The phenomena of diffraction first engaged the attention of Fresnel. It had long been known that the shadow of an opaque body cast by a point-source of light is somewhat different from what would be supposed from simple geometrical considerations, the difference consisting chiefly in an encroachment of the light upon the borders of the shadow. Newton, who called this phenomenon inflection, attributed it to an attractive force exerted by the opaque body upon the corpuscles while in its neighborhood, thus causing an inbending of their paths. Fresnel showed that this explanation was quite untenable, since the inflection caused by the back of a razor is exactly the same as that caused by the edge, although in the former case it is manifest that the time during which the corpuscles are subject to the deflecting force is far greater than in the latter. By similar appeals to ingenious crucial experiments he demonstrated that none of the current theories was sound; but far from resting here, he showed that all the observed phenomena could be perfectly accounted for in the undulatory theory of light, by an application of the principle of Huyghens. Extending this principle, so fertile in his hands, to wider fields in the domain of optics, he found in every case that the new method was adequate to yield perfectly satisfactory results. With quite simple and natural hypotheses as to the conditions which must exist at the common boundary of two transparent media, he was even able to deduce quantitative laws governing the phenomena of reflection and refraction, which accord surprisingly well with experiments devised to test them.

A few years before the commencement of Fresnel's activities, Malus, while looking through a double-image prism, observed that the two images of a distant window which happened to be in such a position as to reflect light strongly to his eye were quite different in brightness, and that under some conditions one image might entirely disappear. Further study showed that all ordinary transparent substances were capable of thus modifying light by reflection, and that the modification is complete at an angle which is simply related to the refractive index; moreover, that under the latter conditions the light would be transmitted through doubly refracting crystals in certain directions without bifurcation. Such modified light is called polarized light, and the phenomena thus briefly described are two of the simplest of an enormously extensive class, many of which are of extraordinary beauty. This discovery and those which quickly followed in the same field presented a host of new and difficult problems to physicists. Of the many active and able workers in this domain Fresnel was easily the leader. In a very few years he had proposed and developed a general theory of light which embraced these new phenomena and which stood almost unquestioned until our own day; and even now the most essential principles of his theory are wholly unshaken. In its barest outlines the theory may be described as follows: Fresnel assumes that the motion of the particles which constitutes the vibrations of light is always in a direction at right angles to the line of propagation of the waves. When the paths of the particles are quite irregular or without order, the light is ordinary light; but when the paths are similar, whether straight lines, ellipses with their axes parallel, or circles with a common direction of motion, the light is said to be polarized. From this simple hypothesis he succeeded in erecting an extraordinary structure which harmonized and explained nearly every known phenomenon of light in a manner that until the most recent times practically withstood all destructive criticism. Even recent achievements in this field of science have been supplementary to, rather than subversive of, Fresnel's general work. Of the phenomena known to his contemporaries, that of dispersion alone was unconsidered by him, a phenomenon which obviously depends upon the ultimate molecular structure of the refracting substance and which has recently been reduced to comparatively simple laws. This great work of Fresnel was looked upon, as indeed it well deserves to be, as one of the greatest monuments to the human understanding — comparable to Newton's doctrine of universal gravitation — and it long remained of almost unquestioned authority. Ultimately, however, one of its fundamental postulates, namely, that the vibrations are always at right angles to the direction of the motion of the light, began to give rise to difficulties. The fact also that the theory could not determine specifically whether the direction of vibration of plane polarized light is in the plane of polarization or perpendicular to it was not only a manifest incompleteness, but it was a constant stimulus to a critical inspection of its premises. The more these points were studied the more insoluble the difficulties appeared, until there came to be a tolerably widespread belief that the theory was not only incomplete, but that in some way it must be essentially in error. To acquire a notion of what modern science has done to clear up these points, we must first review a class of phenomena which seem to be totally unconnected with optics, but which in the end will afford a very remarkable example of the tendency of all science toward unity.

In 1845 Faraday discovered that if polarized light is passed through a transparent substance in a magnetic field and in the direction of the field, the plane of polarization is rotated. The amount of rotation for a given substance is found to be proportional to the strength of the magnetic field and to the length of the path in the material. As many substances, such as turpentine, a solution of common sugar, quartz crystals in the direction of their crystalline axes, etc., present us with a similar fact, this would not be so surprising save for a remarkable difference in the two cases which may be thus described: When the plane of polarization is rotated by passing through a sugar solution or a similar body, and the transmitted light is reflected back upon its course so as to retrace its path, it is found that the original angle of polarization is perfectly restored by a precisely equal rotation in the opposite direction in the return; but a similar experiment upon the body given the magnetic rotation shows a doubled change of angle. This indicates that, although in the first case we must explain the rotation by the molecular constitution of the material, we are not permitted to suppose that the magnetic field has produced a similar molecular structure in the second case, since the rotation is constant in direction irrespective of the direction of motion of the light. Of course, from the known nature of magnetism, this is equivalent to asserting that there must be some relation between light and electricity. But this is not the most obvious connection between these two classes of phenomena, for as we now know, the earliest division of materials in accordance with their electrical properties involved a classification according to their most characteristic optical properties also. Thus all conductors of electricity, excepting only those liquids which undergo a chemical decomposition when they transmit an electrical current, and therefore belong to an obviously different class, are extremely opaque to light; conversely, all substances which are good insulators are also transparent to light, at least to an extent which would make a sheet a few hundred-thousandths of an inch in thickness appear perfectly transparent, although such a sheet of metal or similar conductor would not differ greatly in opacity from a thick plate. An excellent illustration of the generality of this law is furnished by the element carbon, which in the dense opaque form — like graphite, for example — is a very good conductor of electricity, but in the form of the transparent diamond is an insulator.

Before the middle of the 19th century two methods of measuring electrical magnitudes had been developed; one of these is based upon the repulsion which exists between two electrically charged bodies, and the other upon the repulsion which exists between two similar magnet poles. Elaborate and repeated investigations have demonstrated that if a given electrical magnitude is measured according to one of these systems, and the value thus found is compared to a measurement of the same quantity in the other system, the ratio involves a velocity only. This statement is quite independent of the kind of magnitude chosen for the experiment. Within the limit imposed by unavoidable errors of observation the value of this velocity always appears to be the same as the velocity of light.

Here, therefore, are three distinct relations between light and electricity, which have long been known and to no one of which it is possible to attach any a priori reason. It was left to Maxwell to illuminate this obscure field. His long and successful investigations in electricity and magnetism, especially his efforts to reduce Faraday's brilliant discoveries to correlation and to a consistent scientific statement, led him to the conclusion that light itself consists of electrical vibrations. He attempted to test the validity of this hypothesis by every means at his command. For example, according to his theory a non-magnetic substance ought to have a dielectric constant, or what Faraday named its specific inductive capacity, equal to the square of its index of refraction. This indicated relation was found to hold with all expected precision in some cases, but to be widely removed from the truth in others. Again, since, according to the theory, only those substances are transparent which will offer a resistance to the motion of electricity within them analogous to elastic reaction, there ought to be a determinable relation between electrical conductivity and opacity. Maxwell attempted to find this relation in the case of gold-leaf, which is sufficiently thin to transmit a measurable portion of the light falling upon it. Notwithstanding that the discrepancy was here found disappointingly great, the gradual accumulation of knowledge of the more recondite phenomena of the electrical field had led the great majority of physicists to the conclusion that Maxwell's theory was at least a close approximation to the truth, and accordingly one of the most brilliant discoveries of the 19th century. This may be regarded as a fair statement of the attitude of the world of science in 1888, when Hertz, a German physicist, made a series of remarkable experiments which have eliminated all possible doubt as to the essential verity of Maxwell's theory of light. Fortunately it is not difficult for us to gain a sufficient knowledge of the character of these experiments to make clear their general bearing.

It had long been known that a Leyden jar suddenly discharged through a thick wire gives rise to an oscillatory current of very brief duration, and that in certain simple cases the period of the oscillations can be calculated with considerable accuracy. Hertz recognized that during the time of discharge such an electrical circuit must be a source of oscillatory changes in the magnetic field, which, if the views of Maxwell are in accordance with fact, should be propagated through space with the velocity of light. Although it is difficult, if not quite impossible, to measure directly this velocity, if one knows the wave-length and the period it is perfectly easy to deduce the velocity from these two elements, since in its period every wave moves a distance equal to its own length. In these experiments the period was calculated from the elements of the electric circuit; it only remained therefore to determine the length of the waves. Hertz accomplished this in the following simple and ingenious manner: At a considerable distance from the source of the waves he placed a large sheet of metal perpendicular to its direction from the source. From this sheet the waves were returned upon themselves by reflection. Now, a well-known fact in wave motions is that when two systems of waves of like period are moving in opposite directions, they combine to form a system of standing waves of half the length of the free waves. The regions where motion is destroyed by this kind of interference are called nodes. Hertz demonstrated the existence and position of these nodes by means of an apparatus which possessed the same electrical period as the source. This apparatus he called a resonator. The value of the velocity of these waves deduced from his observations differs no more from the known velocity of light than would be expected from the unavoidable errors of observation; thus it complies with the requirements of Maxwell's theory. These waves, therefore, are shown to differ from light waves only in their enormously greater wave-lengths, and that they must be subject to all the established laws of optics which are independent of the length of the waves. The last conclusion was thoroughly tested by Hertz by a series of most interesting and convincing experiments. He found that strictly according to the laws of optics these waves are reflected from the surfaces of all bodies which conduct electricity; that they readily pass through substances which behave as insulators; and that in passing from one insulating medium to another the direction of propagation is altered in accordance with the law of sines. Further than this, he showed that such electrical waves admit of polarization, and they are, therefore, characterized by motions at right angles to the direction of propagation. During the time which has elapsed since these investigations a host of experimenters have improved the methods and apparatus of Hertz, and have largely extended the range of wave-lengths that can be observed. On the other hand, many investigators have been employed in the application of analysis to both the old and the new problems in optics. The difficulties which attach to Fresnel's mode of regarding the optical phenomena of crystalline media are found to disappear, and all the complex phenomena of light admit of explanation from a consistent body of premises.

Reflection — Refraction — Dispersion.— When light waves originating at a point fall upon a surface separating two media, the system of waves is broken up into two systems, one of which remains in the first medium, though moving in a changed direction, and the other entering the second medium. The former system constitutes reflected light, and the latter, also in general changed in direction, is called refracted light. If the bounding surface is smooth the phenomena of reflection and of refraction are regular and the modified paths of the light can be calculated. The total intensity of the reflected light varies greatly with the nature of the media on either side the interface and also upon the angle at which the wave surfaces meet this surface. If we consider only the case of the first medium being air, we may describe two general cases of interest. (1) If the second medium is a transparent substance, like most liquids, ice, glass, etc., the reflected light is ordinarily of small intensity as compared to the incident light, but increases with increasing angle of incidence, until, as this angle approaches 90 degrees, the rate of increase becomes very great. (2) If the second medium is a metal the reflected light is ordinarily a large portion of the whole, but its intensity does not vary greatly with the angle of incidence. Turning now to a consideration of the light which passes the interface and enters the second medium we find that in some substances these waves will go a great distance without notable diminution of intensity. Such substances are called transparent. In others, described as opaque, the light waves are converted into other forms of energy in longer or shorter distances, and are destroyed as light. In the case of metals and other good conductors of electricity this destruction follows a penetration of only a few millionths of an inch. The laws which determine the directions of the reflected and refracted light are simple. Let us call the angles which the incident, the reflected and the refracted waves make with the surface separating the two media, the angles respectively of incidence, of reflection and of refraction. For the law of reflection, the angle of reflection is then equal to the angle of incidence. For refraction, the sine of the angle of incidence divided by the sine of the angle of refraction is equal to the velocity of the propagation of the waves in the first medium, divided by the velocity is the second medium. The angle of incidence being the polarizing angle for transparent substances, the tangent of the polarizing angle equals the index of refraction. This is known as Brewster's law. These laws are not absolutely without geometrical ambiguity, but are made so by the addition that the change of direction in both cases is the least possible. If the refracted light is observed critically it will be found that the direction varies somewhat for lights of different colors, so that, if white light is incident, the light will be arranged in direction according to its component colors, the red being least changed, then yellow, green, blue, and, most of all, violet. This phenomenon is called dispersion. Since the maximum difference of deviation for small angles of incidence is never more than a small part of the whole — very few substances exhibiting a ratio greater than one-twentieth — dispersion should be regarded as a secondary phenomenon of refraction.

Optical Images — Optical Instruments.— When light waves originating at a point are modified by one or more smooth surfaces — either by reflection, or refraction, or by a combination of the two — so that after these modifications they either pass through a new point or seem to do so, this new point is called the optical image of the first. To distinguish the cases of real points from those which only appear to be new centres, the terms real image and virtual image are employed.

If an optical system can form an image, real or virtual, of a point, it follows from the law of continuity that it will also form simultaneous images of near lying points with a like degree of precision; the images of remoter points, however, may be, and in general will be, imperfect. The simplest of all optical systems is a plane mirror, and it is the only optical instrument which is absolutely perfect, provided only that it is not of too small dimensions. Such an instrument forms virtual images of all points in front of it, the sources and images being symmetrically placed with reference to the plane of the mirror. Bodies of transparent substances bounded by smooth curved surfaces, ordinarily spherical surfaces, are called lenses. Almost all optical instruments employ lenses for producing the required modification on transmitted light. If a lens increases the curvature of the wave-surfaces which pass through it — which in general requires the middle of the lens to be thicker than its periphery — it will produce real images of remote objects near its geometrical axis. Such a lens is called a *positive-lens*. A screen to receive the images and an opaque enclosure to shield it from extraneous light constitutes the important instrument known as the camera obscura. One of the earliest optical instruments invented, it has only been of importance since the discovery of a method of fixing the images a short time before the middle of the last century. The requirements of modern photography, especially the demand for brightness and wide angular extent in the images, have led to inventions of wonderfully complex camera lenses, so that ordinarily they are made of combinations of from 4 to 10 different lenses, involving two or three different kinds of glass in their construction.

The eye is properly a camera obscura, in which images of objects neither too near the observer nor too far from the axis of vision are formed upon the retina as a screen. The most important difference between the eye and the photographic camera lies in the fact that the interior of the eye is filled with a substance optically different from air, which introduces some remarkable modifications in the phenomena of vision. These may be ignored in this casual review of the construction and function of optical instruments.

In almost all optical systems, excepting the camera obscura, the eye is a necessary part in use, and it is, therefore, convenient to specify the conditions under which distinct vision is possible. To a normal eye, any object very near the axis of vision can be distinctly seen if it lies at a distance comprised between five or six inches for a nearer limit and infinity for the farther. Thus, the moon and a printed page held at the customary distance for reading can be seen equally well. We shall assume a distance of 10 inches as a standard of comparison.

Microscope — Telescope.— If a small object be brought quite close to the eye it will appear larger, but when too close vision will be indistinct. This is because the refractive power of the eye is insufficient to cause the light waves to form new centres at the retina; but if the refractive power of the eye be suitably increased by the aid of a positive lens placed between it and the object, vision is rendered distinct with the increased apparent size. A lens so used is called a simple microscope and the ratio of the apparent diameter of the object to that which it would have at the conventional distance of 10 inches is called the magnifying power of the miscroscope. Since nature presents us with innumerable examples of such microscopes in small drops of water, of transparent resins, etc., the phenomenon has doubtless been known since prehistoric times, and we have the best of reasons for believing that some of the artisans of antiquity employed magnifiers as aids in their work.

There is no theoretical limit to the magnification attainable with simple microscopes except that set by the nature of light itself, but very high powers demand inconveniently small lenses and such close approximations to the eye that illumination of the object becomes difficult. These difficulties can be greatly reduced by employing two systems of positive lenses, one of which serves to form a *real* and enlarged image of the object, while the other is a simple microscope used to observe the real image quite as if it were the object itself. The former system is called the objective, or object-glass, and the latter the ocular, or eyepiece. The instrument thus constituted is called the compound microscope, and its magnifying power is equal to the product of that of the objective into that of the ocular. The compound microscope was invented about the middle of the 17th century, but it was not perfected so as to be of real value as an instrument for scientific research until after the second decade of the 19th.

If a lens, or lens system, is employed to form a real image of a distant object and this image be viewed through a microscope, the combination forms a telescope. Since the real image is in general inverted, the object appears inverted to the observer if he employs a simple magnifier as an ocular, but it appears erect if the ocular is a compound microscope. The inverting telescope is optically superior and is universally used for astronomical observations, but for terrestrial observations the second type is ordinarily preferred, which, when it is desired to distinguish it by a name, is called a terrestrial telescope, or a spy-glass. The terms objective and ocular are also applied to the two lens systems in the telescope.

Since concave mirrors can also produce real images of distant objects they may be used in place of the objective. Such instruments are called reflecting telescopes; they have been very extensively used for astronomical purposes in the past.

Achromatism — Achromatic Combinations.— Newton was led by his experiments to conclude that the secondary phenomenon of dispersion bears a constant ratio to the refraction. It follows from this that a separation of composite light into colors is the inevitable concomitant of change of direction by refraction, and that this imposes a somewhat narrow limit upon the power of all optical instruments involving refraction. This belief led him to invent the reflecting telescope, which remained the leading form for astronomical purposes for more than a century. About the middle of the 18th century, however, Dolland found that Newton's conclusion was founded upon too limited a range of experiment and showed that it is possible, by a combination of two or more materials, to secure a change of direction of light by refraction with little or no evident dispersion. Thus, he found that a prism of crown glass, say of 10 degrees, combined with a prism of flint glass of 5 degrees, turned in an opposite direction, would yield a deviation nearly as great as a prism of crown of 5 degrees and without the colors of dispersion. Such a combination is called an achromatic combination, and a pair of lenses similarly combined to give colorless images is called an achromatic lens. All refined optical instruments utilize this invention of Dolland. In telescopes the objective ordinarily consists of two members only, a positive crown lens combined with a negative (diverging) flint lens; in microscopic objectives there are rarely less than four lenses, and sometimes, in the case of very high powers, not less than 10.

Interference Phenomena — Diffraction.— That light is in fact some form of wave-motion does not appear from the phenomena of reflection and refraction in their commoner manifestations, although if the acting surfaces are made very small there are deviations from the simple laws given above which inevitably lead to a wave theory for an adequate explanation. For the present purposes it seems far better to describe some of the simpler and easily produced phenomena which demonstrate the wave-motion.

One of the most striking properties of all varieties of waves is their propagation independently of the state of motion of the medium in which they exist, for example, water waves of all possible lengths and having all possible directions of propagation may coexist on a single surface of water. In familiar acoustic phenomena we have excellent analogies which will greatly help in the comprehending of the less familiar optical phenomena. If two tuning-forks of exactly the same pitch be sounded together it is found that there are regions where all evidence of sound vanishes, provided that the forks are equally loud. These regions of silence are those where the maximum of density due to one set of waves corresponds with the minimum of the other set, and they are so simply related to the positions of the two forks that having established their places, it is easy to deduce from the geometrical relations the length of the waves. Could we get two sources of light which emitted waves exactly alike, there should be corresponding regions where illumination from the two sources would be wanting, provided that light is in fact produced by a wave-motion. Since, however, the ultimate sources of light are the molecules of luminous bodies and we are unable to control such small bodies, so simple a test is impossible; but a perfect optical image of a source is exactly like the source itself, hence, if light is allowed to fall upon a screen and a portion of the same radiation is reflected by a mirror upon the screen, the conditions for interference are met. The experiment is a delicate one and liable to escape observation, only, however, because of the shortness of the waves. Fresnel tried the experiment, not only by using two mirrors, enclosing an angle a very little less than 180 degrees, but also by using two prisms of very small angle, with complete success. The advantage of using a pair is obvious when similarity of the two sources — here two virtual images of the same source — is considered. His measurements showed that the waves which are found in ordinary white light have all lengths between those of $\frac{1}{33400}$ and $\frac{1}{56000}$ of an inch, the former being that of the extreme red of the prismatic spectrum, and the latter of the extreme violet. The mean value for white light may be taken as $\frac{1}{45000}$ of an inch.

A much easier, though less simple, method of exhibiting interference phenomena is the following: If a hole, less than $\frac{1}{50}$ of an inch in diameter, be pierced in a piece of paper, a distant bright point, such as an arc light or the bright point of a mercury thermometer-bulb in sunshine, will appear to an eye looking through the hole as a disc surrounded by one or more concentric rings. If now a second similar hole be made within less than $\frac{1}{20}$ of an inch from the other and the experiment be repeated, the disc will appear brighter and traversed by a series of dark lines perpendicular to the direction of a line joining the two holes. These dark lines mark the regions of complete interference and are exactly like the dark bands produced by Fresnel's method. The fact that the point-source of light appears as a disc of appreciable magnitude is also explicable by the fact that light is a wave-motion. Broadly stated the condition is this: if light consists of waves, we ought not to expect that the laws of reflection and of refraction will hold unmodified when the acting surfaces are no longer large with respect to the length of a light-wave. These deviations from the laws are called diffraction.

Since most of the light with which we ordinarily experiment is composite, that is, made up of a combination of many different wave-lengths, the places of complete destruction of illumination differ for differing wave-lengths. Such phenomena are, therefore, generally, sometimes splendidly, colored. Familiar cases of simple interference are presented by thin reflecting plates, such as soap-films, rifts in transparent media, as in precious opal, etc. In these cases we have the two sources produced by reflection from the two sides of the plates, and the phenomena are generally known as the colors of thin plates, first studied by Newton.

Diffraction phenomena are even more commonly seen. The peculiar lustre of satin spar, of the gems known as cat's eye and of the star sapphire find their explanation here. The iridescence of mother-of-pearl and of certain feathers, and the brilliant-colored pattern seen when an electric arc light is viewed through a fine and uniform fabric, like silk or the web of many feathers, are diffraction phenomena of greater regularity than the former group.

Optical Phenomena of the Atmosphere. — Of the many optical phenomena which belong either to the air as a transparent body or because of foreign bodies temporarily suspended in it, mirages, coronas, rainbows and halos are among the most striking. The refractive power of the air increases with its density, and, as this is increased both by pressure and by lowering of temperature, there results varying effects of refraction. With the normal condition of the air, in which the density increases in a geometrical ratio as we rise above the surface of the earth, the only very obvious effect is to prolong the length of the day to twice the time which it requires the sun to sink at the horizon by its own diameter. Atmospheric *reflection* is well illustrated by twilight; this reflection takes place partly from the air itself and partly from minute, solid particles in the atmosphere. It commonly remains visible until the sun has sunk 18 degrees below the horizon, which indicates that at a height of 50 miles above the earth's surface the air is still dense enough to reflect an appreciable amount of light. Atmospheric dispersion is also present, but is not sufficiently marked to be detected by the unaided eye, although conspicuous enough with a telescope under favorable conditions. The scintillation of the stars, however, is a direct effect of atmospheric dispersion.

In the not infrequent cases when the air departs widely from the normal law of continuous decrease of temperature with increasing height above the surface of the earth, the paths of the light waves which are nearly horizontal may change the direction of curvature between the object and the observer, in other words, may have points of inflection. In low latitudes the prevailing condition, when such abnormal refraction may be observed, corresponds to a lower layer of air at a higher temperature than that immediately above. In such cases distant objects near the horizon appear lifted above their real positions and portions of these much elongated vertically. A further development shows inverted images, generally without much distortion, underneath the raised images. Over sun-heated plains the inverted image is that of a portion of the sky, whence the effect of a sheet of water between the observer and the horizon. In high latitudes it is sometimes possible to find the condition of a layer of much cooler air in contact with sheets of ice or of cold water, in which case the inverted image is seen above the erect image. These phenomena are known under the name of mirage.

When the atmosphere is not quite clear one may sometimes see colored circles concentric with the sun or moon, generally not more than four or five times the diameter of the sun and invariably having the inner edge blue. Such circles are called coronas. They are diffraction phenomena produced by very small spherical drops of water suspended in the air, and their diameters are in an inverse ratio to the diameter of the drops to which they are due. The only necessary conditions for well-developed coronas are smallness and general uniformity of size in the drops.

When sunlight falls on drops of water which are not small compared to the length of a light wave, an entirely different phenomenon, involving reflection, refraction and dispersion, results. It can be shown that, when flat wave-surfaces of light enter a sphere of water, there are two cases in which a portion of the wave emerges from the drop still nearly flat, and that in these directions, therefore, the light will be transmitted with relatively great intensity. The first case corresponds to refractions at entrance and emergence with a single interior reflection; and the second case to the two refractions separated by two interior reflections. The total change of the direction of the light in the former case is 138 degrees and in the latter 231 degrees. It, therefore, follows that all drops at these two angular distances from the sun should appear relatively bright, in other words, that opposite to the sun there should appear two concentric circles under proper conditions of illumination, one, much the brighter of the two, of 42 degrees radius and the other of −51 degrees radius. The secondary phenomenon of dispersion causes these angles to vary continuously for different wave-lengths, hence the circular arcs, constituting the double rainbow when perfectly developed, appear as bands of prismatic colors. It is not difficult to see that the primary bow, often the only one which can be traced, must be red on the outer border, whence we conclude from the algebraic sign attached to its radius, that the secondary bow should present the red border on the inner margin.

When the temperature is low, water cannot exist in the form of drops, but only in that of snow crystals and of a perfectly transparent vapor. On those occasions when there are numerous ice crystals of very regular form suspended in the air and illuminated by the sun or the moon, we may see one or more of a series of highly complicated phenomena which bear the names of halos, parhelia, sun-dogs, etc. A bare description of all the features which have been observed and recorded would demand far more space than is available; only the most common ones can be noted here. The simplest form of ice crystals, and the only form which is necessary to produce all the known forms of halos, is that of a right hexagonal prism. Such a body supplies two refracting angles, namely, that of 60 degrees contained between two alternate faces of the prism, and that of 90 degrees embraced between each of these faces and a base. As light traversing a 60-degree prism of ice has a minimum deviation of 22 degrees, if there are present a sufficient number of such prisms between the sun or moon and the observer, the luminous body would seem to be surrounded by a concentric circle of 22 degrees radius, having, on account of the secondary effect of dispersion, a red inner margin and a pale bluish outer one. Similarly the rectangular edges would give rise to a colored circle of 44 degrees radius. The smaller circle can be seen very frequently — perhaps on 60 to 80 days a year in our latitude — while the 44-degree circle is rarely seen.

When the length and width of a small hexagonal prism differ greatly, it will not remain while falling through quiescent air in a purely chance position, but it will set itself more or less perfectly in a definite position with respect to a vertical. Thus a flat prism will fall with its base horizontal, and an elongated crystal will maintain its axis nearly horizontal. This peculiarity in falling crystals produces a large number of features in complicated halos which are generally recognizable because they are all symmetrical with respect to a vertical circle passing through the sun. Some of these are comparable with the most brilliant rainbows in their coloring. The most familiar of this class of phenomena are the two bright prismatic spots to the right and left of the sun, respectively, having the same altitude as the sun and their red side turned toward the sun. When the sun is very low they are 22 degrees distant and appear merely as bright portions of the inner halo, but as the altitude of the sun increases they increase their angular distances, and above a moderate altitude they disappear. These spots are called parhelia, or sun-dogs; they are sometimes the only feature of the halo visible and are by no means infrequent. See also Camera; Electricity; Electric Light; Microscope; Polarization of Light; Telescope; Vision.

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LIGHT, Therapeutics of. In medicine light has been used from the earliest times, and the therapeutic application of sunlight is an empirical mode of treatment, in many diseases, which has been handed down through generations. The reaction of the human body to different degrees of light is very striking, and however various the sources of light, the mode of reaction is often marvelously similar. Thus, the surface capillaries of the skin are dilated, there is exudation of serum into the subcutaneous tissues, and the nerve-endings are stimulated. The results of the application of light widely vary, the variations depending upon the area exposed and the part affected. At the present time sunlight is used as a general tonic and as a special tonic to the skin, while as a disinfectant its powers are systematically applied. There is undoubtedly a life-giving principle or growing stimulus in sunlight. Men and animals require it as well as vegetation. It is markedly helpful in tuberculosis and in numerous sanitoriums it is now customary to give sun-baths to the patients. The solarium (q.v.) is being revived and ought to regain popularity, for people who lead an indoor life require some such stimulus to maintain health.

LIGHT, Velocity of, the rate at which light is propagated. This may be found either from astronomical observations or by direct terrestrial measurements. Of the former there are two methods, the first by observations of the satellites of Jupiter and the second by measurement of what is known as the «aberration» of the stars. The satellites of Jupiter revolve regularly around the planet; when the earth is farthest away from Jupiter there is a delay of 16 minutes, 38 seconds in the times at which they are seen to enter the planet's shadow, as compared with the corresponding times when the earth is nearest Jupiter. Thus it is found that it takes light 16 minutes, 38 seconds to pass across the earth's orbit, a distance of 186,000,000 miles: the velocity thus found is 186,330 miles a second. As the passage of a moon into the planet's shadow is, however, a gradual phenomenon, the true instant of its disappearance cannot be accurately determined. This method of determining the velocity of light is hence not susceptible of accuracy; it has, however, a high historic interest, since it was in this way that Roemer, in 1675, first discovered that light requires a definite time to pass through space.

The second astronomical method depends upon the aberration of the fixed stars. It can be shown that if the transmission of light is not instantaneous, then when a star is viewed from our moving earth it will appear constantly displaced by a small amount from its true position. This displacement will be a forward one in the plane in which the direction of our own motion at the instant lies and which also contains the ray of light from the star; the amount of the displacement varies as the quotient of the observer's velocity divided by the velocity of light. The total effect of all displacements as the earth passes around its orbit is that each star appears to describe a small orbit in the course of a year about its true place. The motion of the earth in its orbit carries the spectator at one time so as to increase the relative velocity of the light from the star and at another time so as to diminish this velocity. The maximum displacement of a star due to this cause is the so-called «constant of aberration»; its value is 20.47". The velocity of light corresponding to this is about 186,000 miles a second.

The most accurate method of directly measuring the velocity of light on the surface of the earth is by causing a ray to be reflected from a very rapidly rotating mirror to a distant fixed mirror and finally back to the first mirror again. If the time occupied by the ray in passing from the first to the second mirror and back again is sufficiently long so that the first (revolving) mirror has taken a new direction, the ray after its last reflection will take a different course than it would have done had the first mirror been at rest. From the known velocity of rotation of the mirror, and the measured amount of the deflection, the time taken by the ray in passing twice over the course which separates the two mirrors can readily be computed. In this manner Newcomb, in 1882, determined the velocity of light in air to be 186,273 miles a second. From theoretical considerations it is known that the velocity in a vacuum should be slightly greater, and upon applying a correction for this cause the final value of 186,324 (in a vacuum) resulted. An equally accurate determination afterward made by Michelson led to the value, 186,320. The uncertainty of these values hardly can exceed 15 or 18 miles a second.

It is a matter of importance and interest to ascertain whether the above value of the velocity for white light also represents the velocity of transmission of light waves of different colors. But this question is readily answered by a consideration of the behavior of eclipsing variable stars. Even with such stars so distant that their light requires from 30 to 100 years to come to us, we find that rays of all colors reach us simultaneously upon the eclipsing body being removed. It is thus certain that to a very high order of approximation the velocities of transmission of light waves of all different wave lengths are equal.

LIGHT OF ASIA, The. The story of the life and teaching of Gautama, founder of Buddhism, was published in 1879. Sir Edwin Arnold, then editor of the London *Telegraph,* had gained through some years of life in India and study of its literature the interest in its thought and poetry that produced not only 'The Light of Asia' but 'The Indian Song of Songs' and other translations and reproductions. Out of the mass of tradition, legend, and record that sprang up about the life of Buddha, Sir Edwin has drawn a figure of real dignity and charm. The poem narrates Gautama's renunciation of wealth, royalty, and love for the sake of sharing the common lot and delivering his people; his attainment, after years of suffering and solitude, of the Nirvana of Enlightenment. A greater artist might have given us a poem of greater imaginative beauty and poetic power. The bent of this poet-journalist and the taste of his public produced an elaborate

Orientalism of descriptive detail that is often effective, but less convincing to a Kipling-fed generation. The exposition of Buddhism has been criticized both by scholars and by theologians. In substance it is not inaccurate but inadequate, not only because of the exigencies of poetic form but because of a lack of the completer data produced by the critical scholarship of the last 30 years. The verse, though sometimes stately, is often prosaic or pompous.

To us, the chief interest of 'The Light of Asia' is its testimony to the 19th century concern with the Orient, which, expressed in the romanticism of 'Lalla Rookh,' was to inspire the scholarship of the Pali Text Society. So successfully did Sir Edwin Arnold popularize Buddhism, we are told, that in spite (or because) of the opposition of English pulpits, 60 editions of the poem were sold in England and 80 in America. To-day 'The Light of Asia' at least fulfils the author's wish by preserving "the memory of one who loved India and the Indian peoples."

FRANCES W. CUTLER.

LIGHT-HORSE HARRY. See LEE, HENRY.

LIGHT AND SHADE.* We are able to distinguish objects owing to our ability to discern differences in brightness and in hue or differences in light, shade and color. If we did not possess the gift of color-vision the magical drapery of color would disappear and the gray of dawn would persist throughout the day. The color-blind eye, which is otherwise normal, sees only the series of neutral grays from white and black. These the artist terms "values." Brief consideration is convincing that "Light and Shade" is an extensive subject of great importance to us because of its relation to vision, to the appearance of objects, to the imitation of objects and to everything, with the exception of hue, which appeals to human consciousness through the doorway of vision. Although color is useful and appealing to man, generally he is much less conscious of its existence than he is of form, or brightness distribution. It is the distribution and modulation of light and shade which model form, so that as an essential to vision the perception of color is much less important than the perception of "values" or brightnesses.

Objects are visible usually because they emit light either by transmission or by reflection but there must be a contrast either in brightness or in hue in order that they be distinguishable from their surroundings. Furthermore, objects are modelled by the distribution of light, shade and color upon their surfaces. In order to eliminate the necessity of including color in the present discussion the objects which may be considered will be assumed to have neutral surfaces, that is, white or gray. Even the surface characteristics of objects play an important part in their appearances. There are many kinds of surfaces from the regularly reflecting mirror to the diffusely reflecting surface such as blotting paper, or powdered zinc oxide. A study of these surfaces and of their appearances under different kinds of lighting is of vast importance in relation to vision and to the imitative arts.

For example, assume two gray spheres, identical in every respect except that one has a glossy surface and the other a dull one. If lighted by a small light-source at a considerable distance from them, they will appear identical when in the same position with respect to the light-source except for the brilliant high-light on the glossy sphere. This high-light is an image of the light-source formed by the glossy convex surface. If the surface is optically convex the image will be seen to be reproduced in accurate minute detail. If the two spheres be illuminated outdoors under an overcast sky, the comparatively less brilliant high-light will extend over a large area and will be unnoticed. The minute high-light of the small light-source in general will not be at a point on the sphere nearest the light-source or the observer but will be found to lie on an element of surface which is so oriented that the angle of incidence of the beam from the source is equal to the angle of reflection of the beam of light reaching the eye by regular reflection from the object. On changing his position the observer will note that the position of the high-light changes so that this simple law of optics is always fulfilled.

The character of the lighting has much to do with the appearance of an object. If the dull sphere receives equal amounts of light from all directions it will not appear spherical but will appear to be a flat disc. No modulation of light and shade is present to model it. If the glossy sphere be placed at the centre of a diffusing glass globe which is uniformly illuminated over its exterior, the sphere will appear flat. However, under most conditions the brilliant high-lights will reveal its form under lighting conditions which would "flatten" the dull sphere.

Metallic moldings owe their appearance quite predominantly to these bright high-lights which are more or less perfect images of the light-sources. It is interesting to note the effect of the medium on the expression of sculptured objects. A Venus in white marble of dull surface is most beautifully expressive of the human body but the same figure in polished bronze is sometimes hideous with grotesque metallic high-lights. These effects are illustrated in Figs. 1 and 2, respectively. On the other hand, a bay horse may be well represented in polished bronze and the appearance of a sculpture of a swarthy-skinned Indian is quite congruous if done in semi-polished bronze. This does not mean that the artist may not display his skill in any medium but it brings forth the fact that the medium influences the final appeal of the sculpture to us through the appearance for which it is partly responsible.

Shadows are of utmost importance from many standpoints. The cast shadow is the shadow of an object upon another surface and the shadow is that on the object itself. Although these two classes of shadows are subject to different minor influences they are in general subject to the same major influences. In this brief discussion they will be considered together. There are three dominant factors which influence the appearance of shadows: (1) The position of the dominant light-source determines their general direction; (2) the solid-angle subtended by the light-source determines the character of the shadow-edges; (3) the amount of light scattered or diffused by the surroundings determine the brightnesses of the shadows. By controlling these three factors the sculptor, the photographer, the lighting specialist, the architect, the museum director and others are able to produce the desired modelling of the subject.

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* The courtesy of D. Van Nostrand Co. is hereby acknowledged for their permission to use the accompanying illustrations and other material which have been taken from the author's book on 'Light and Shade and Their Applications,' 1916.

The sculptor does not actually strive to reproduce an object in true relative dimensions. He paints in light and shade with his chisel by leading lines and areas of light and shade in order to fix an expression of light. The appearance of a model depends upon the lighting and in a similar manner the final product should receive a proper lighting resulting from thoughtful consideration of these factors. But these factors appear not to be considered in many museums because we often find sculpture displayed collectively in large rooms in which these factors differ widely. A large skylight flattens the objects especially if the surrounding walls and floors are highly reflecting. In general, sculpture should be exhibited amid brighter surroundings than paintings because the shadows should not be too dark. Dark, sharp shadows produce a harshness and severity appropriate to a relatively few subjects but in general the light-source should be extended to a moderate solid-angle and the shadows should receive an appreciable amount of light from the surroundings.

The effects are usually more satisfactory if the object is so placed with respect to the dominant light-source that the shadows fall aslant. In large rooms sculptured objects are usually displayed to the best advantage when near the walls and properly oriented. Such rooms when illuminated by windows are usually less satisfactory owing to the multiple shadows due to two or more light-sources (windows) and to the nearly horizontal direction of the dominant light. The effects of the position of a small light-source are shown in the upper four illustrations in Fig. 3. The lower four illustrations show various lighting effects as noted in each case. The head is a plaster cast of the head of Laocoön and it is evident that some of the lights fail to suggest the tragic expression of this wonderfully expressive antique sculpture. In the lightings shown in Fig. 3 an attempt has been made to illustrate the influence of the three factors already noted so that they do not represent complete lightings which would ordinarily be encountered. However in Fig. 4 are shown three lightings which were just as found in practice. The head was placed on the wall at a height of five or six feet in a room having windows on two sides and equipped with direct and indirect lighting fixtures hung from the centre of the ceiling. The harsh effect of the direct lighting is evident. This is due to the small solid-angular extent of the light-source measured at the object and to the relatively less light which falls upon the shadows. The indirect lighting, in which the ceiling is the dominant source of light, produces softer shadows, because their edges are less defined and brighter. The unsatisfactory direction of daylight and the effect of multiple shadows from the three windows—two on one side and one on an adjacent side—is evident in the third illustration in Fig. 4. The best lighting of this subject as is usually the case is from a source at an angle between the horizontal and the vertical. The ideal method of exhibiting three-dimensional objects is to provide an environment and lighting suitable to the object. This ideal is seldom possible of attainment in practice but it may be approached in various ways. Objects may be placed near the walls and properly oriented if the light-source is a ceiling skylight, an indirectly lighted ceiling or a central fixture. They may be placed in alcoves and thus obtain an approximation to an individual environment or they may be grouped in small rooms which are properly lighted. If windows are used they should be located high as a general rule. It is interesting in this connection to study various museums for there are many unsatisfactory conditions to be found and some which indicate distinct steps toward the ideal in respect to lighting and other environments.

Low relief is not so susceptible to careless lighting although highly diffused light or such a condition as approximately equal intensities of light from several directions has a greater tendency to flatten it and it should be lighted in general with more directed light than sculpture of true dimensions. Incidentally it is of interest in this connection to note that low relief approaches the principles of drawing usually more closely than the principles of sculpture in true dimensions.

The portrait photographer and also the portrait painter deal with the same modelling characteristics of light and shade. Large skylights, especially on dark days, cannot be sufficiently reduced in area to render satisfactory modelling in most cases without reducing the intensity of illumination to a low value which is often unsatisfactory. Artificial light-sources are much more adaptable to the needs of both the photographer and the portrait painter because they are more readily controlled as to solid-angular extent, position and general distribution of light. Such units are available and are being adopted for this work. One of the chief principles of obtaining light and shade effects in the studio is shown in Fig. 5. If *ab* represents a vertical skylight the same light and shade effects will be obtained at *o* by a light-source of the size of *cd* or *cf* if the other dimension is reduced a corresponding amount in each case. Thus the same effect may be obtained with a smaller source placed closer

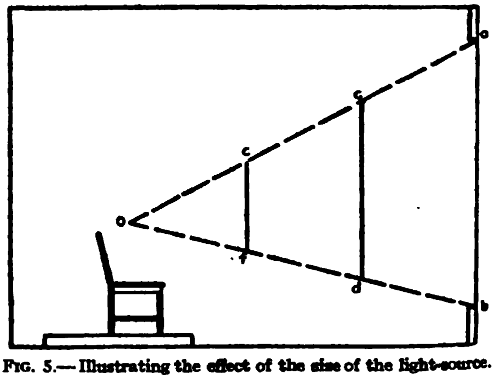


FIG. 5.—Illustrating the effect of the size of the light-source.

to the subject and it is evident that a smaller room may be used.

The architect depends finally upon light, shade and color to realize his desired effect. By means of modelled ornament, pigments, lighting effects and relative brightnesses of the various important areas, the architectural picture is completed. Numberless architectural interiors testify to the lack of a common goal for all those who contribute toward the light and shade effects. The distribution of light and shade largely influences the mood or spirit of the interior and the simple laws which govern light and shade effects should be applied with the final aim definitely in mind. The importance of lighting in architecture may be seen in any interior and it may be illustrated by photographing an interior under different lightings or by means of a detail. In Fig. 6 are shown the various expressions of the same molding under five different lightings. Lighting is often responsible for certain illusions as well as for the expression or mood of the interior as a whole. For example, if a row of columns or pilasters be of high brightness as contrasted with a dark background they will appear more massive than when they are in deep shadow against a bright background. Innumerable effects of light and shade are visible on every hand. Notwithstanding this fact the author is perhaps the first to attempt to formulate the science of light and shade and to relate it to the art.

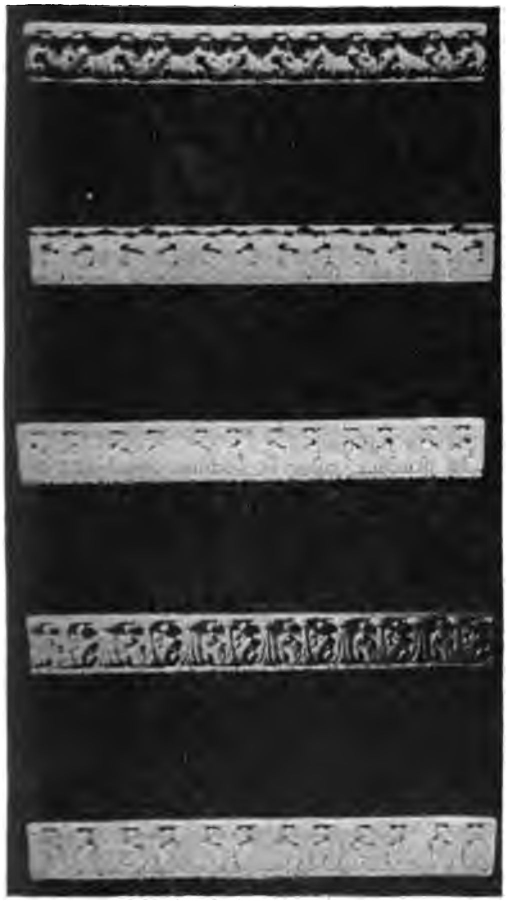


Fig. 6.— Different lightings of the same moulding.

The decorator arranges his values in an interior just as a painter would in a landscape or other scene, but these values do not depend alone upon his pigments for they must borrow light and reflect it in order to be effective. Therefore the relative values of the different areas in an interior depend also upon the intensities of illumination. But usually the decorator and the lighting specialist work independently and the final effect is not that which either had contemplated. It is a compromise depending upon the relative effectiveness of the illumination intensities and of the pigments. The decorator usually decides upon his values in the daytime and the distribution of light is playing a part in the values which he chooses for the various areas. The lighting specialist who installs the artificial lighting provides a radically different distribution of light with the result that it is not always harmonious.

The stage presents a picture in light, shade and color. Here more than in any other activity is lighting used for its expressive value. But bound by tradition and prejudice and handicapped by lack of familiarity with the simple laws of light and shade, the stage picture is full of incongruities and even grotesque effects. The footlights, common to the theatre, produce unnatural expressions of the human face as well as of the entire scenes. Throughout the ages during which the prejudices and artistic tastes of mankind have been formulated, dominant light from below the horizontal has never been a factor. The effects which it produces are unnatural and have no logical place in the stage picture excepting for unusual purposes. The footlights are of value in contributing, along with the borders and sidelights, a dim "fog" of light for illuminating the shadows but there is an opportunity for someone to come forth with a combination of architecture and lighting in the theatre which will produce artistic light and shade effects. The possiblities in such effects range from a concentration of light to a flood of it and from a picture in silhouette against a bright background to the reversed effect of a bright picture against a dark background. The modernists in the theatre are striving to eliminate such incongruities as the grotesque effect of footlights, the conflict of painted and real shadows and perspective. Not long ago a stage-setting often consisted of meagre furnishings and all kinds of objects and shadows were painted upon the enclosing scenery. The painted shadows were usually incongruous with the real shadows and the perspective could not be correct from all viewpoints. Later some producers introduced furnishings in great detail which have the advantage of real shadows but may be criticized from many viewpoints, the chief one perhaps being the distraction from the drama itself. In the modern theatre the aim is to produce harmony of action, lighting and setting with the drama and this appears best brought about by simplicity in lighting and in setting. This is accomplished by proper light and shade (also color) effects and by real shadows; in fact by utilizing the language of light, shade and color.

The skeleton of any picture is its values or distribution of light and shade. Painting is an imitative art which depends upon pigments but the limitations of these are a great handicap to the artist. The greatest range of contrast on an artist's palette is represented by white and "black," but the latter is never a total absorber of light, and white is merely a relative term. The amount of light reflected by the best white pigment is about 90 per cent and the purest black pigment ordinarily found among commercial pigments reflects several per cent of the incident light. Therefore the ordinary range of contrast in brightness which the artist is able to command is about 30 to 1; that is, his white is only 30 times brighter than his black under equal intensities of illumination. With these he must represent the extreme range of values in a landscape in which the sky is commonly hundreds and even thousands of times brighter than the deepest shadow. This is one of the reasons why the artist must resort to illusions in imitating nature. In photography the same difficulties are met and when the scientific facts are realized it is quite wonderful that the painter and photographer are able to satisfy us with their products. This approaches the psychological aspect of light and shade and we must conclude that the imagination of the observer supplies much that is missing in the painting or in the photograph. In fact it is perhaps true that nearly all that we experience in viewing such a work of art we must supply. The work of art is merely an object which taps the imagination of the observer and by associations, memories and imagination he is capable of putting into the picture that which he desires. Of course this does not apply to the æsthetic value of the picture which arises from its own harmony of parts, its rhythm and its grace of line. A simple example of interest from the psychological aspect is the appearance of a white hemispherical cup lighted by a source of fairly large solid angle. If the surroundings are such that no inkling of the position of the light-source is possible, this object will invariably be taken for a hemispherical solid lighted from a source exactly opposite to the actual position of the source. It is called a hemispherical solid or even a sphere because the light and shade distribution is similar but reversed and because these objects are more commonly encountered than the hemispherical cup.

Inasmuch as values are such an important factor in painting, photography, architecture, sculpture and in everything which appeals to the human organism through the doorway of vision, it is of interest to have a standardized value-scale. Textbooks on art usually include a scale of shades from white to black but such a scale should be standardized in order to have a definite meaning. From an acquaintance with pigments and with the practical requirements of a value-scale the author has proposed the following standardization which is applied to the nine values commonly used by the artist.

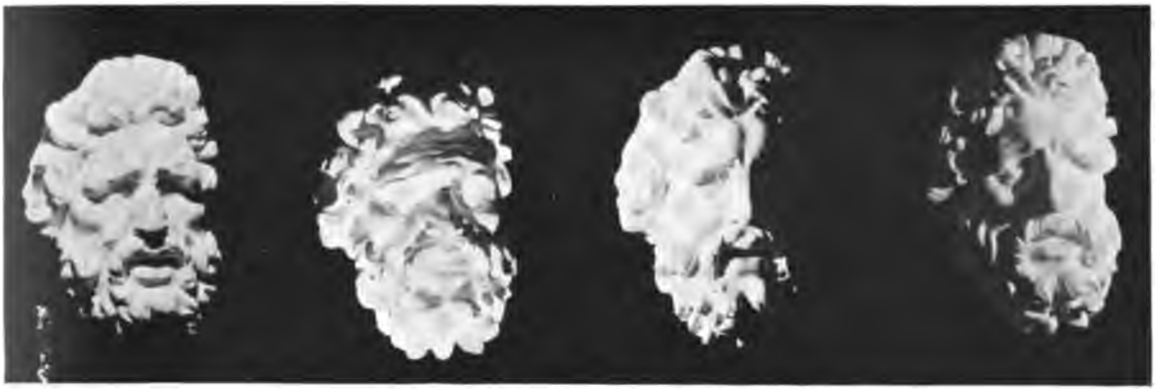
Value	Reflection factor (per cent)	Value	Reflection factor (per cent)
Black	0 to 10	Low light	50 to 60
Low dark	10 to 20	Light	60 to 70
Dark	20 to 30	High light	70 to 80
High dark	30 to 40	White	80 to 90
Medium	40 to 50		

The whitest pigment reflects about 90 per cent of the total incident light and, although white is a relative term, those pigments which reflect 80 per cent or more of the incident light are commonly considered white. The ordinary black pigments often reflect as much as 10 per cent of the incident light but usually less. These facts have formed the basis of this standardization and a value-scale can be divided in this manner and subjected to measurement. If the scale be printed upon the best grade of white paper the highest value will be about 80 per cent or slightly above and the lowest value will be somewhat under 10 per cent because the best black ink, under the conditions of printing, reflects an appreciable amount of the incident light. Such a standardization at least eliminates the ordinary crudity of visual estimates and should have a place in the scientific aspects of light and shade.

It is an obvious conclusion from the foregoing that the distribution of light and shade is not fixed by pigments but depends upon the relative illumination intensities as well. For example, a black pigment which reflects 10 per cent of the incident light will appear as bright under nine units of illumination as a white pigment which reflects 90 per cent of the incident light will appear under one unit of illumination. If both pigments are perfectly neutral (without hue) they will appear identical under these conditions of illumination. This is often a startling revelation to those who use pigments and it emphasizes the fact that black and white are merely relative terms. This indicates that uneven distribution of light on large flat areas and on paintings may be very effective in enhancing contrasts. Experiment shows this to be true and that along this line there are possibilities in lighting.

In practice, color is seldom separated from values or distribution of light and shade and it has its influence upon values. For example, let us take two pigments, red and blue of a given tint or shade. They possess certain values or relative brightnesses under a given illumination. Let us assume that their values are the same under daylight illumination, then under the illumination from a tungsten lamp the red will appear considerably brighter, not uncommonly twice as bright. On the value-scale this change under the latter illuminant would often amount to enough to raise the value of the red to the next higher value. There are many interesting influences of color on light and shade as will be apparent from observation and from a study of the science of color. All of these have their place in the art of light, shade and color but unfortunately relatively few artists are familiar with the underlying scientific principles. It is a noteworthy fact that masterful artists are commonly familiar with the sciences underlying their art and this is to be expected because there is nothing mysterious about art. Mysteries are merely facts which are not understood and to the scientist in light, shade and color there are fewer mysteries in art than to the artist himself. It is true that the æsthetics of light, shade and color have less scientific foundation than the physics and physiology of the subject but æsthetics is a science which is not yet completely explored or unraveled.

LIGHT AND SHADE



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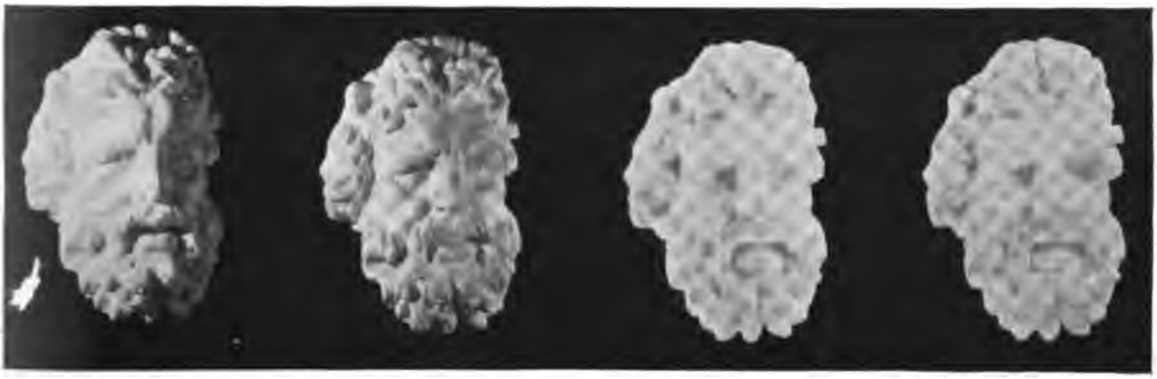


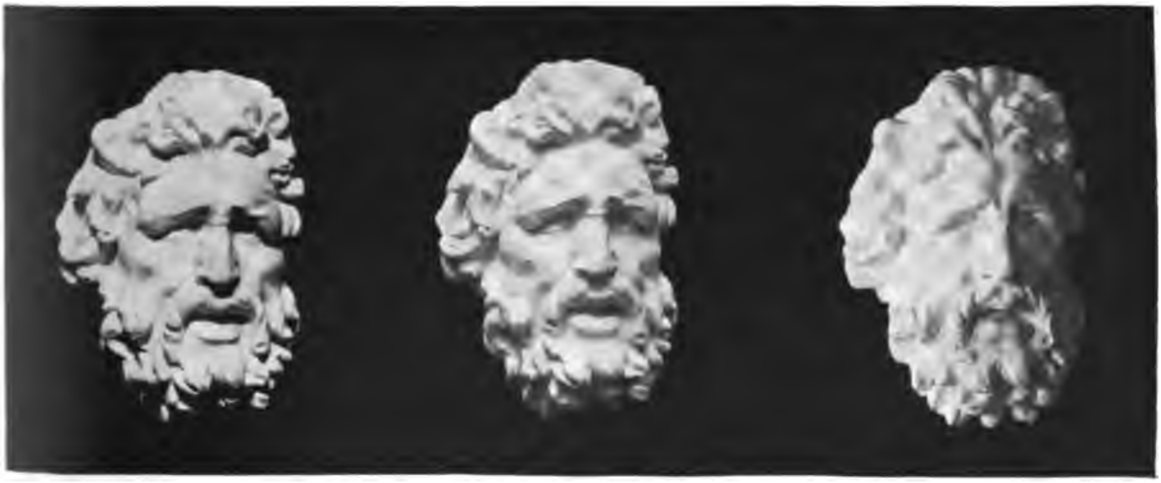
Point source on left Diffused light on right

Point source on left Diffused light on right

Diffused light

Four point sources

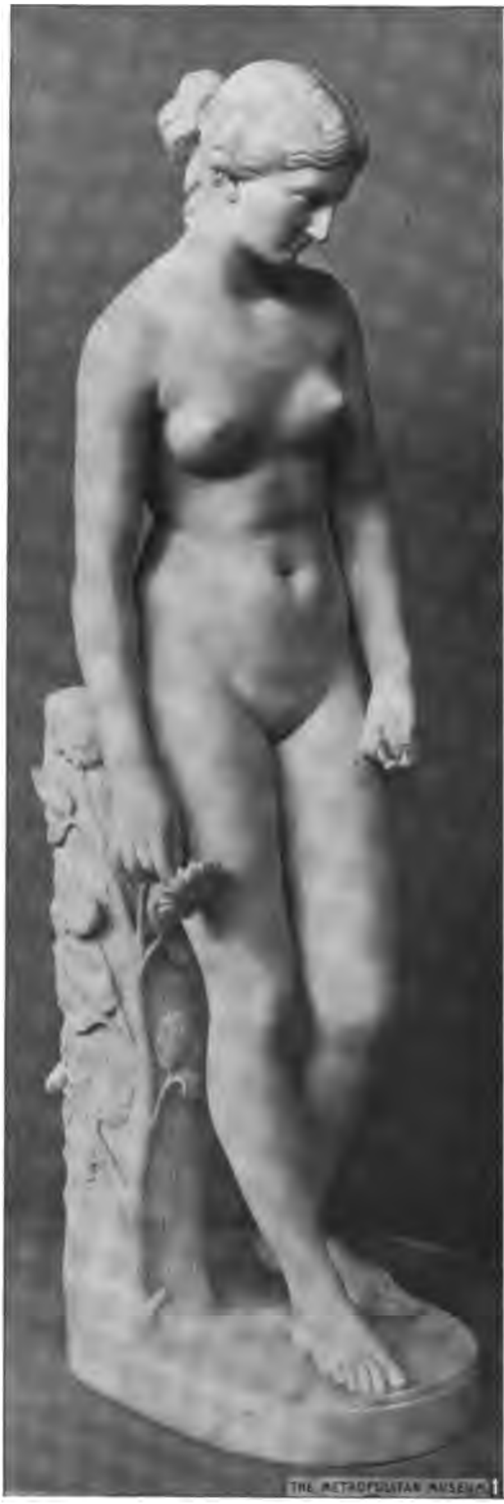
Fig. 3 Different lightings of the head of the Laocoön



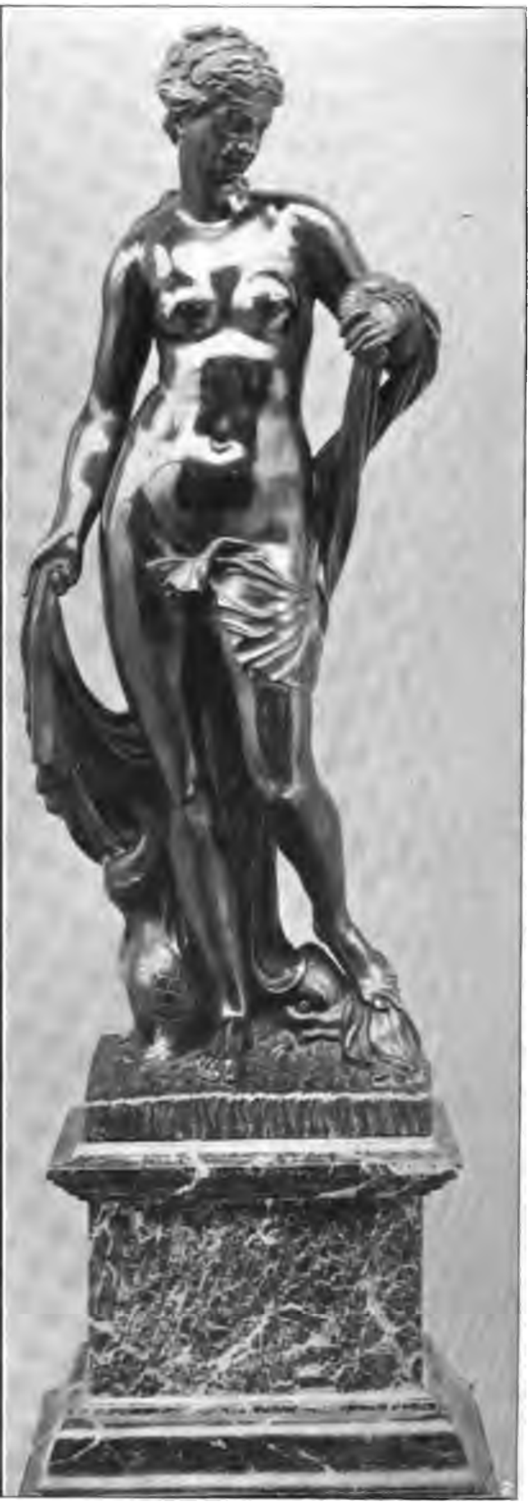
Direct lighting Indirect lighting Natural lighting from windows

Fig. 4 The Laocoön head in the same position in a room lighted by three ordinary lighting systems

LIGHT AND SHADE



1 Clytie, by W. H. Rouchart in marble



By courtesy of Metropolitan Museum of Art

2 Venus, by C. G. Allegrain in polished bronze

Having had a glimpse into various aspects of light and shade it should be of interest to note a few facts pertaining to nature. We go to nature for many lessons, for here we find a picture gallery containing an infinite variety of canvasses. Any individual scene is continually changing, so nature provides unlimited opportunities for studying light and shade as well as color. Some idea of the variety in nature's lighting is obtained when it is noted that on a cloudless day the direction of light from the sun varies throughout the day from horizontal to vertical and again to horizontal at sunset. Most of this time the sky is contributing from 10 to 30 per cent of the total light. Here we have a combination of a powerful directed light with a weaker light from the hemisphere of sky. Add to this variety that from an infinite number of different combinations of light from clouds, sky and sun, and end the brief review with the perfectly overcast sky, and it must be concluded that the light and shade effects in nature are numberless.

It is an interesting fact that on a perfectly overcast day no object on the earth's surface can be brighter than the sky unless it be self-luminous. On cloudless days a white object may be as much as 10 times brighter than the sky although usually it is about six times brighter. Incidentally the clear noon sun is many million times brighter than the shadows in a landscape.

It is difficult to discuss the artistic aspect of light and shade in nature because this involves taste which, in general, is more or less indeterminate. However a few points will be brought forth because they appear so definitely established after years of observation. Variety is perhaps the keynote of nature's beauty. Take a scene which may appear commonplace at midday on a clear day and it is not uncommon for it to be enchanting in the early morning or late afternoon. A study of this scene appears to indicate definitely that the beauty near the ends of the day is due to the long shadows and hence a greater variety in light and shade. A clear sky may be pleasing in its tranquillity, but to be beautiful or powerfully effective variety is necessary and this is obtained by cloud effects. Great areas of uniform brightness such as an overcast sky conspire with the absence of defined shadows to produce an effect toward which we are indifferent and often displeased.

It is interesting to note that the sharply defined shadows outdoors on a clear day are not annoying and are even very pleasing yet shadows of a similar sharp contour are usually displeasing indoors under artificial lighting. The difference may be accounted for by the much greater luminosity of the shadows outdoors and the adaptation of the eye to a much higher level of illumination intensity so that the contrasts are less violent. These points might well be borne in mind in the practice of artificial lighting. A symmetrical distribution of light in interiors produces effects which approach the light and shade of nature and the finer sensibilities recognize that there is much to be gained in departing from the common symmetrical distribution of light in artificial lighting systems.

It is seen that light and shade is of great importance in many activities, both from the scientific and artistic viewpoints. It is the most important factor in vision because everyone is more conscious of form than of color; however color plays a part in vision even though unconsciously. For example, in providing an illumination for a certain activity it is well to study how the perception of the objects is best accomplished. It may be that certain small objects may be best seen outlined in shadow against a bright background or vice versa. If they have polished surfaces, the regularly reflected high-lights may be of the greatest importance. Thus it is seen that the background is a large factor in the discrimination of objects.

The shadow is an important factor in modelling an object and the cast shadow likewise lends its aid. Under the illumination of an overcast sky or an indirect lighting system, objects are less distinctly visible because in these cases only the profile or silhouette is the dominant factor. Under such conditions of illumination much of the advantage of the modulation from light to shadow and of the form of the cast shadow is absent. Although somewhat disadvantageous in the perception and recognition of fine detail, such types of light-distribution are exceedingly applicable to some classes of problems. Perhaps no system of lighting has been as successful as the so-called indirect lighting in producing light and shade effects befitting the spirit or mood of an interior. An excellent field for such observations is in churches because so many types of architecture are available and the different creeds call for different expressions of the interior. This is not commonly recognized but it is nevertheless true and the possibilities of lighting in this respect have been recognized to some extent even though subconsciously.

Without taking the space to summarize this article, which in itself is a brief summary of an extensive subject, it may be repeated that light and shade must be ranked as one of the most important factors in human existence because it is the most essential factor in vision. It is a many-sided subject, embodying the scientific aspect of the appearance and hence of the discrimination of objects, the æsthetic aspect of many scenes, the psychology of light, the aims and limitations of the imitative arts and many other aspects. See ART DRAWING.

M. LUCKIESH,
Nela Research Laboratory, National Lamp Works, General Electric Company.

LIGHT THAT FAILED, The, by Rudyard Kipling, a novel first published in 1891, tells of Dick Heldar, a young artist, who after vivid experiences of war in Egypt scores a decided success in London. There he again meets his boyhood sweetheart, Maisie, striving for fame as a painter. He loves her but she is wholly bound up in her ambitions. Dick suddenly goes blind. He finds that Maisie is incapable of making a sacrifice for his sake and goes back to Egypt to be killed in a skirmish. Opinions in regard to this book are widely divergent, many critics finding fault especially with Maisie, whom the *Edinburgh Review* found to be «utterly uninteresting, which is the one thing that a heroine may not be.» On the other hand there is undoubted power and interest in the portrayal of the hero, his adventures, his friends and acquaintances. Furthermore, Richard Le Gallienne, by no means an unqualified admirer of Kipling, said, «Nowhere else that I know of has the hopelessness of blindness been so brought home to us. . . . 'The Light that Failed' is perhaps the story of all Mr. Kipling's stories that strikes the most universal note of human pathos.» The story, before its issuance in book form, appeared in *Lippincott's Magazine* with a conventional «happy ending.» This version, though rejected by the author as not his original conception, has been used in the successful dramatization of the novel.

Arthur Guiterman.

LIGHTER, a flat boat or barge for transporting merchandise on rivers and canals, and to and from vessels moored in a stream, or where they cannot be laden from or discharged on to a wharf or pier alongside.

LIGHTHOUSE, a structure on some conspicuous point of seashore, island or rock, or on the bank of rivers and lakes, from which a light is exhibited at night as a guide to mariners. Lighthouses are generally placed on salient points, each requiring structures specially designed to meet the exigencies of varied sites. When placed on headlands or large islands lighthouses are very much alike in general features, the differences being mainly in the height of the towers, depending on the distance at which the light requires to be seen, and the lighting apparatus. Towers erected on isolated, wave-swept rocks in the open sea, such as the Minot's Ledge and Spectacle Reef in the United States, the Eddystone, the Bell Rock, Skerryvore and Chickens Rock lighthouses in Great Britain, and that of Bréhat in France, are triumphs of engineering.

History.— The history of lighthouse building and illumination may be said to extend over a period of more than 2,000 years; but the regularly organized life-preserving system of modern lighthouse engineering goes back very little further than the beginning of the 19th century. None of the early lighthouse buildings now exist. The Pharos of Alexandria (331 B.C.) gave its name to its successors. The Romans built lighthouses at Ostia, Ravenna, Puteoli and other ports. The Phœnician Pharos at Coruña, repaired during the reign of the Roman Emperor Trajan, was re-established as a lighthouse about 1634, and in 1847 had a dioptric apparatus placed in it. On the cliff at Boulogne there are the remains of a lighthouse ascribed to Caligula (40 A.D.), and at Dover there are remains of another Roman Pharos. Until the end of the 18th century the lighthouses of the United States and of Great Britain were few in number, and of an inferior description in the great essential of a lighthouse, namely, sending the greatest number of rays of light toward the horizon. In the United States of America the first act of Congress relating to lighthouses was passed in 1789. Many of the public lights in England were private property, as was also the case with the Isle of May in Scotland, the patent for which was ratified in 1641. There were only 25 lighthouse stations and six floating lights in England at the beginning of the 19th century. The coast and harbor lights in Great Britain and Ireland are now upward of 1,000 in number.

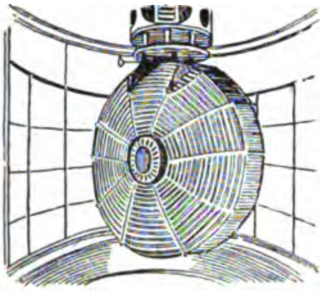
The early lighthouse towers had on their summits grates or chauffers, in which billets of wood or coal were burned, but though expensive to maintain — some of them using 400 tons of coal yearly — were uncertain in their appearance, varying with the ever-changing character of the atmosphere. Such coal-lights survived in Scotland till 1816, in England till 1822 and on the Baltic till 1846.

Construction.— The difficulties of building are very great, the greatest usually being to effect a landing of men and material. At Minot's Ledge, off the Massachusetts coast, General Alexander got only 30 hours of work in the first year, and 157 in the second, and the earlier histories of the Bell Rock, Skerryvore, Dhuheartach, Chickens, Eddystone in Great Britain and others tell the same tale. The cost of lighthouses may vary much; for instance, Spectacle Reef, on Lake Huron, cost $300,000; an ordinary land station, fully equipped, will cost much less — as a matter of fact, about $25,000 to $50,000. Light-vessels cost about $45,000.

These towers are constructed of steel, or hard stone, such as granite, or cement-concrete faced with hard stone, and of such a mass and strength as to prevent their being overturned or destroyed by the waves. A typical stone lighthouse is built of granite, say 140 feet in height, with a diameter at the base of 42 feet and at the top of 16 feet, and contains 58,580 cubic feet, or about 4,308 tons of masonry. A staff of four light-keepers is attached to such rock lighthouses, three residing in the lighthouse and one on shore, the reliefs being fortnightly, so that each man has six weeks on the rock and two weeks ashore. At land lighthouse-stations, where women and children can be stationed, the keepers' families reside with them, and the staff consists of three men when there is a fog-signal, and two men when there is only the light to attend to. It is considered essential that a constant watch be kept in the light-room during darkness to ensure the proper exhibition of light.

Optical Apparatus.— The object of using optical apparatus in a lighthouse is to direct, as far as possible, all the rays of light that proceed from the *radiant*, or source of light, so as to be visible only on the sea between the near sea and the sea horizon. In the Eddystone lighthouse, up to the commencement of the 19th century, the lighting apparatus consisted of a chandelier of tallow candles, though parabolic reflectors made of facets of silvered glass mirror, set in a mold of plaster of Paris, were introduced in 1768 and used in several lighthouses, the effect of these reflectors being to concentrate and throw seaward the rays of light from a flat-wick lamp placed in the focus. At a later date reflectors composed of sheet copper, plated with silver and formed into a parabolic curve, were largely introduced and are still in use. These reflectors, where a fixed light was desired, were arranged in two tiers on a frame, as many as 26 being necessary to show a light of equal power all around the horizon, and in the case of flashing lights seven were grouped on each of four faces of a frame that was rotated by clockwork. This mode of lighting is termed *catoptric*, or reflecting system. The method of building lenses of separate rings or prisms of glass, so as to form a larger lens than could be obtained from

LIGHTHOUSE



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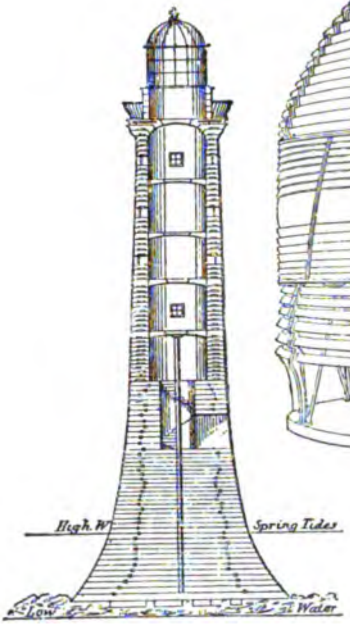

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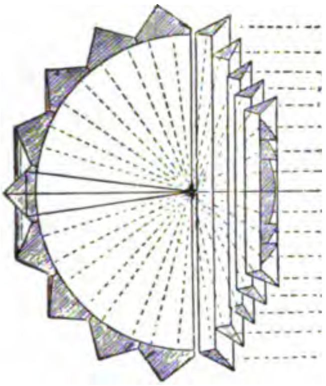

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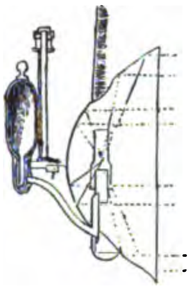

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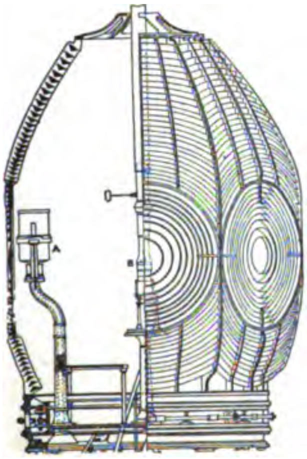

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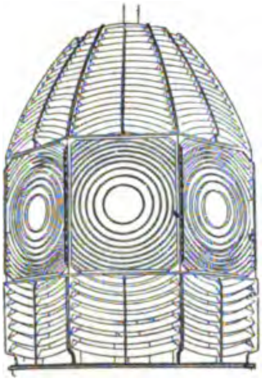

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1 New Revolving Light, Barnegat, N. J.
2 Holophotal Univalve Apparatus with Dioptric Mirror
3 Sectional Plan of Bell Rock Tower
4 Fixed Dioptric Light
5–7 Parabolic Reflector with Oil-fountain Lamp
6 Elevation of Triple-flashing Apparatus

a mere bull's eye formed of one piece of glass, was first adopted for lighthouses in 1822. For a fixed light the built-up lens was so arranged as to form a polygon with one burner in the focus, and for a flashing light annular lens panels were grouped round the one central burner and revolved by clockwork. In 1892 Charles A. Stevenson made the lenses spherical in form in the vertical plane, and in 1895, with great advantage of the power of the light, abolished the old section of the elements and gave them an equiangular section. This equiangular profile also permits of the refracting elements being extended to 80 degrees of focal opening, and indeed farther, without loss of efficiency. The setting of lenses eccentrically has rendered possible a diminution in the diameter and consequent saving in cost of lantern and tower. Besides the fixed-light apparatus and the lens panels many other forms of prisms for various purposes have been introduced. Thomas Stevenson's catadioptric mirror, formed of totally-reflecting prisms, and subsequently improved by James I. Chance, is largely used; and vertical straight prisms, placed in front of either fixed light or holophotal panels, are used to deviate the light azimuthally over particular arcs where the light is required. The desire to increase the power of the lights induced some lighthouse authorities to advocate the use of larger burners without increasing the focal distance of the apparatus, with the result that little advantage was gained, as most of the light was ex-focal. It was not, however, till 1885 that the first *hyper-radiant* lens was constructed, with the result that when tested it was found to produce a beam twice as intense as that from the previous lenses with the same large burners in the foci. This hyper-radiant lens is now largely used where great power is desired. See PLATE.

Radiants.— The radiants used in the focus of the apparatus in foreign lighthouses are generally 1-, 2-, 3-, 4-, 5-, 6-, or even 10-wick cylindrical paraffin burners, though gas burners, incandescent burners and the electric light, both arc and incandescent, are also in use. The use of paraffin resulted in a large saving. The electric light is now generally used in the United States. The popular idea that the electric light is not so good in fog as oil or gas lights was confuted in 1885, when it was found that oil and gas were usually affected by atmospheric variations, that the electric arc light is absorbed more largely proportionately to its initial power by haze or fog than oil or gas lights, but that in all weathers and at all distances its penetrative power was found superior to the gas and oil lights, and that all three are nearly equally affected by rain. These results are confirmed by practical experience in our lighthouses.

Characteristics.— To enable the sailor to distinguish one lighthouse from another, lights in proximity to one another are arranged to exhibit different characters. The characters in common use are: fixed light; flashing light, showing one flash at regular intervals of a few seconds; group flashing lights, showing two or more flashes in quick succession, followed by a longer period of darkness than that which separates the flashes; occulting lights, which show a fixed light and are eclipsed for a few seconds at regular intervals. Colored lights, red and green, are also used with any of the foregoing characters to produce further distinctions, but in general only to mark danger arcs, or in conjunction with a white flash, as the tinted-glass shades interposed to produce the desired color seriously cut down the power of the light, and are not, unless of a very dark shade, easily distinguishable in foggy weath r from a white light.

Machines.— To produce these various characters the lenses are placed on a carriage which revolves on conical rollers, or is floated in a mercury trough, and is driven round by clockwork actuated by a falling weight. The tendency has been in recent years to drive the apparatus faster, so as to make the period phase of the light as short as possible. While this is a desirable object it involves at the same time shortening the duration of the flash on the eye of the sailor, to which there is obviously a limit, if distinct vision is to be obtained under practical conditions. A flash of about half a second in length is regarded as what should be aimed at. The light on the Navesink Highlands above Sandy Hook, N. J., is one of the largest of modern flash-lights.

Lanterns.— The apparatus is placed in a glazed lantern erected on the top of the lighthouse tower. With the view ot intercepting as little light as possible, the framing or sashes are made of as small sectional dimensions as is consistent with strength, and are made either diagonal, with diamond-shaped flat panes, or helical with curved panes. The upper part of the lantern is made dome-shaped with a ventilator to carry off the fumes from the lamp. The size of the lantern varies with that of the apparatus, the usual size for a first-class light being 12 feet in diameter and 10 feet height of glazing.

Lightships.— In certain situations, such as on rocks where there is not sufficient room to get a large enough base for a tower, or on sandbanks where the sand is liable to shift, it is impossible, except at a prohibitive cost, to erect towers to carry the light. In such situations recourse is had to mooring in the vicinity a vessel which carries the light on a mast. The light is generally shown from a lantern formed round the mast, and the apparatus consists of parabolic reflectors or small dioptric apparatus. These light-vessels have a crew consisting of a master, mate and nine men.

Beacons and Buoys are used in situations where powerful lights, such as can be shown from lighthouses and lightships, are not necessary, and where the extinction of the light would cause inconvenience and not disaster, but where some guidance is desirable, as, for example, in narrow sounds, rivers and estuaries. Beacons are now frequently lighted with small dioptric apparatus, the illuminant being either compressed oil-gas stored in a receiver, in which case they need no attention for several weeks, or with oil-burners, in which case they must be trimmed every three days. Buoys are made of various shapes to denote on which side of them the safe channel lies. Thus, can-shaped buoys, those with a flat top, are to be passed on the port hand, and conical-shaped buoys on the starboard hand when the ship is going up an estuary or with the flood-tide, and vice versa. Spherical buoys denote a middle danger which may be passed on either hand, Buoys for particular places are further differentiated by color and top marks. See Buoy.

Fog-signals.— During the prevalence of fog and snowstorms the most powerful lights are obscured, and it becomes necessary to guide the mariner by sound signals. Hence a fog-signal has become a necessary adjunct of a fully-equipped lighthouse station. Various instruments, such as bells, gongs, guns, steam-whistles, explosive charges of tonite, reed trumpets and sirens sounded by steam, electricity or compressed air, are used. The most efficient and powerful fog-signal is the siren sounded by compressed air. In spite of the recent improvements in fog-signals they are undoubtedly the weak point in coast protection, as the exact direction from which a sound is coming is not easy to locate, and owing to the capricious and uncertain range at which sound can be heard. Submarine signals have been developed in recent years and have a more effective and constant range than signals sounded in the air. The usual type consists of a bell of special design, submerged to a distance free from wave disturbance and with a striking mechanism attached. At light stations the bell is often supported on a tripod on the sea bottom and the striking mechanism is operated electrically by means of a cable; a characteristic number of blows at intervals may be given in this manner to identify the station. To obtain the best results with submarine signals, a receiving apparatus is attached to ships; it is similar to a telephone and by it the bearing of the signal can be determined approximately. The sound is heard on ships without the apparatus when the observer is below the water line, and particularly in iron or steel ships, but in this case the bearing of the signal is not easily determined.

Administration.—The United States Lighthouse Board was formed in 1789, and reconstructed in 1852; a reorganization of the Lighthouse Service under Act of Congress took effect 1 July 1910. In Great Britain, the Trinity House of London, the Irish Lighthouse Board and the Northern Lighthouse Board are the lighthouse authorities. The two last named were not constituted till 1786, but the Trinity House may be said to have originated in 1514. The French Commission des Phares was constituted in 1792 and remodeled in 1811. In Sweden, Norway, Holland, Denmark, Russia and Austria the lighthouse administration is under the Admiralty or Minister of Marine. In Spain, the system of administration is similar to that of France. For American administration see the article Lighthouse Service of the United States.

Progress in America.— From one of the poorest-lighted coasts, the American Atlantic seaboard, within a quarter of a century, became one of the best in the world, with a new system of lighthouses and signal lights far more comprehensive than anything heretofore attempted. The Cape Hatteras region, and the scarcely less important Cape Cod district, early received special attention. Both of these capes were in the direct route of commerce, and the storms and shoals that made them dangerous to navigators had to be offset by adequate lights which would warn mariners of their proximity. The first attempts at lighthouse construction were consequently made at a few such danger points along the coast, and from these in either direction new lights were gradually erected. They formed the beginning of the new system which sought to make all of our coast so well protected that navigators need have little apprehension in approaching the land from any direction at any point.

The full extent of the lighthouse service can best be appreciated by simply stating that there are some 14,550 warning lights and signals stretched along the American coast, forming a perfect link so that the navigator need never be beyond the sight of one of the beacons. The "aids," so-called, include a great variety of modern inventions, from the tall flashlight lighthouse, with its base of steel and stone, and costly lamp operated by electric power, to the modern gas and electric-lighted buoys, beacons and lightships. The advances made in lighthouse and buoy construction represent some of the marvels of modern engineering science.

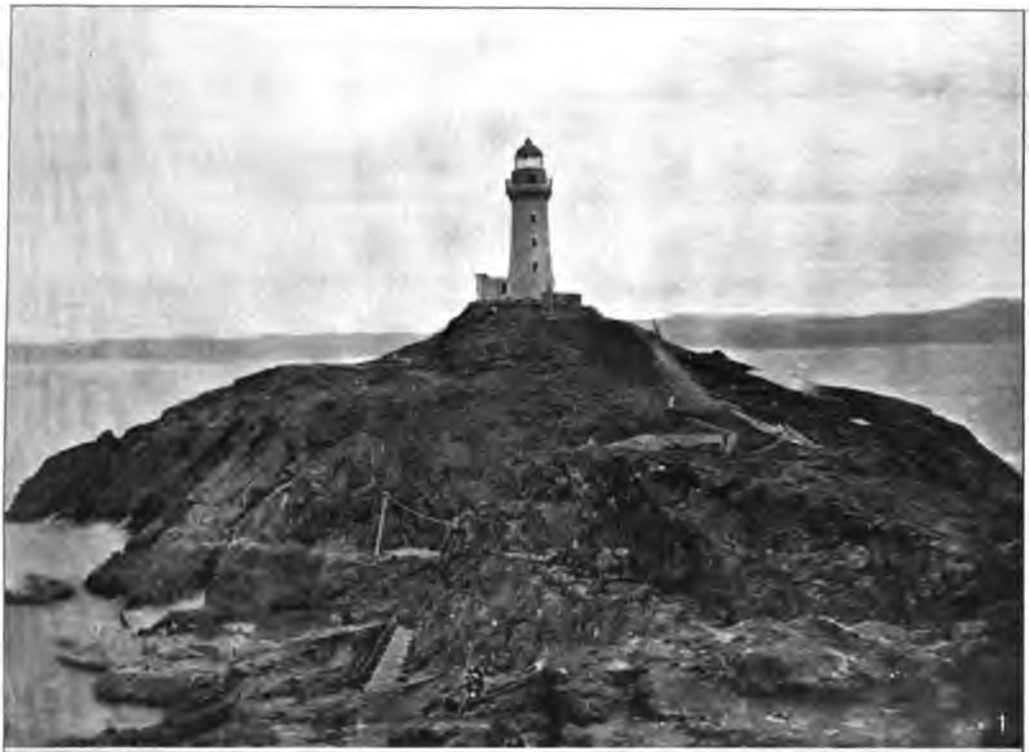
The most important light in the United States, the great tower at Barnegat, N. J., was completed in 1903, with a light equipment equal to 30,000,000 candle-power. Steam and power are generated for local use, for the heart of the light is a 6,000 candle-power arc light. This is intensified by a great lens built up of rims of prismatic glass, with a bull's eye in the centre 18 inches in diameter. This monster light can be seen from the lookout at a distance of 100 miles; but, taking the world's curvature into consideration, from the deck it is seen while still over 20 miles away. The Barnegat station is a most important one, being located on the most easterly point of the dangerous, low-lying Jersey coast. See Plate.

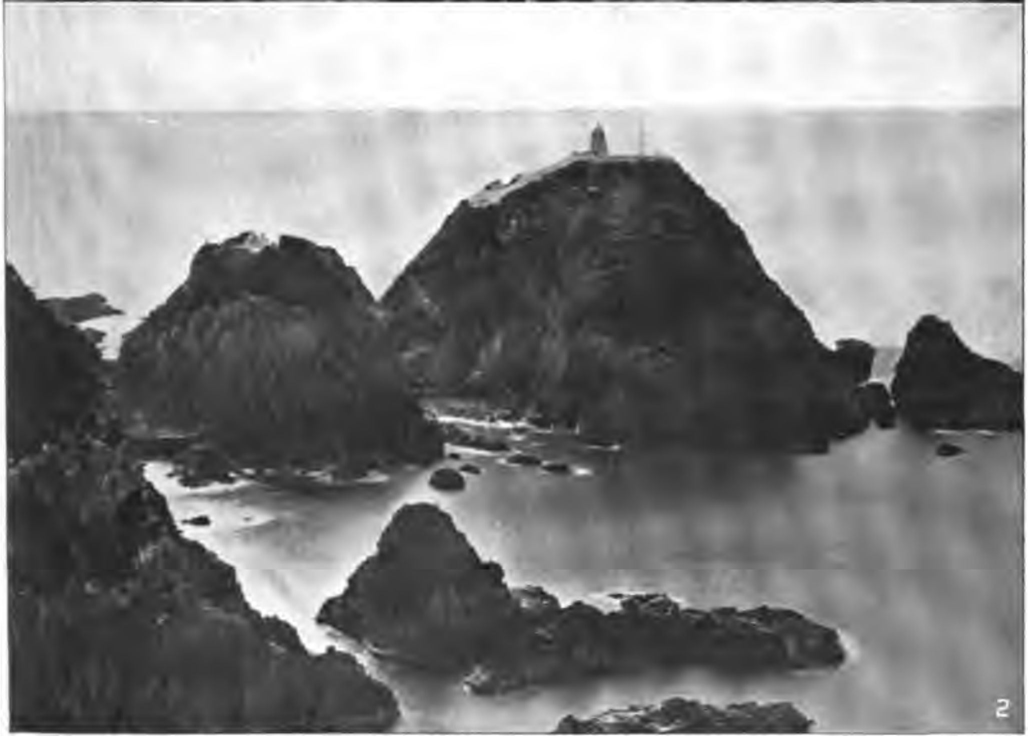
More than 40 lightships are stationed at points along our coast where beacons are necessary, but where the building of lighthouses is impracticable. The Diamond Shoal lightship warns the navigator of his approach to dreaded Cape Hatteras. For years the Lighthouse Board tried to build a lighthouse on Diamond shoal, but at last, after more than $250,000 had been spent and several lives lost, the attempt was given up.

The Fire Island lightship is one of the line of ocean lampposts which mark the entrance to New York Harbor. It is equipped with a steam engine, electric lights, a steam whistle and many other improvements. The new South Shoal lightship, which is anchored 26 miles off Nantucket, is farther from shore than any other lightship in the world. It is the first American outpost and guards a shoal which in times past was a veritable graveyard for ships.

Steel Tubular Structures.— One of the most noted advances in modern times has been the abandonment of the old towers of stone or brick and the adoption of the steel tubular structures in their places. The latter are built more easily on a solid, rocky foundation than the old huge piles of masonry. The steel skeleton is bolted into the solid rock or anchored there by means of long spindle-like legs, which sink many feet down into the firm foundation. These huge cylindrical towers of steel withstand the pressure of wind far better than the stone and brick structures, and their strength is so great that there is practically no danger of their ever being seriously injured by the elements.

LIGHTHOUSES





Courtesy of William Elliot Griffis, Ithaca, N. Y.

1 Rock Island Lighthouse, Japan

2 Lighthouse at Satonomisaki, at the extreme tip of South Japan

Even where the lighthouses are built in the water to mark shoals or dangerous reefs, the steel tubular style of structure is adopted. The foundation work of the structure is built up above the water with stone or concrete, and to this the steel tower is bolted. The latter looks more like a giant smokestack than anything else, and it stands as a permanent beacon of the sea to warn mariners of their danger. Not only is additional strength and security obtained through the adoption of the steel tubular lighthouses, but the cost of construction is greatly reduced. Modern lighthouses cost far more than they did in former days, but that is due to the fact that they are built on a larger and more enduring scale, and the lights are of far greater power and intensity. A modern American lighthouse frequently costs $125,000, and often one-third of this is spent in the electric light and apparatus alone. In the old system the lights represented a comparatively small proportion of the expense.

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LIGHTHOUSE SERVICE OF THE UNITED STATES. Under the act of 17 June 1910 the present general organization of the service is as follows: The commissioner of lighthouses and the deputy commissioner preside over an office in Washington, D. C., which is the executive centre of the service. In this office are an engineering construction division, under the chief constructing engineer; a naval construction division, under the superintendent of naval construction; a hydrographic division, under an assistant engineer, and the general office force, under the chief clerk. Outside of Washington the service is divided into 19 lighthouse districts, each under the charge of a lighthouse inspector. In each district there is a central office and one or more lighthouse depots. Each district is provided with lighthouse tenders for distributing supplies to the various stations and light vessels for transportation of materials for construction or repair and for care of buoys. On Staten Island, New York Harbor, there is also a general lighthouse depot where supplies are purchased in quantities, special apparatus is manufactured or repaired and various experimental work is conducted.

The total number of aids to navigation on 30 June 1915 was 14,544 as compared with 11,713 on 30 June 1910, representing a total net increase during the five years of 2,831, or 24 per cent, an average of 566 per year. For the preceding five years from 30 June 1905 to 30 June 1910 the total increase was 1,793, or an average of 359 per year.

Careful consideration was given, in the interests of economy and efficiency, to the discontinuance of lights and other aids no longer required by navigation, so that the above figures represent a net increase, after allowing for 2,850 aids to navigation which were discontinued during the five years.

Careful attention was also given to the improvement of apparatus and equipment, in accordance with the best modern practice of coast lighting. Gas buoys, which are more appreciated by mariners than any other recent addition to coast lighting, were increased from 225 in 1910 to 479 in 1915, a total increase of 254, or 113 per cent.

The use of oil-vapor lamps increases the illuminating power from a given quantity of kerosene oil by about eight times, and these lights have been greatly appreciated, because of their superior brilliancy. The number of oil-vapor installations at light stations were increased from 80 in 1910 to 286 in 1915, a total increase of 206 stations, or 257 per cent. Most of the primary coast lights are now provided with oil-vapor lamps. On the Atlantic coast, of the 70 primary lights 16 used oil-vapor in 1910 and 64 in 1915; on the Pacific coast 2 used oil-vapor in 1910 and 32 out of the 34 primary lights used oil-vapor in 1915.

Many of the older lights were fixed and did not have a characteristic which would distinguish them from other lights. Steady progress was made in changing such lights, where doubt might occur, to flashing or occulting, and 169 lights were so improved in the five-year period mentioned. Especially marked progress in this respect was made on the Pacific coast, where of the primary lights in 1910, 11 were fixed lights, whereas in 1915 only 2 out of 34 are fixed lights; of the total primary lights on the Atlantic and Pacific coasts in 1910, 65 were flashing or occulting and 37 fixed, and in 1915, 80 were flashing or occulting and 24 fixed.

There was a strong demand for improved lighting of Alaskan waters, and the number of lights on the coast of Alaska were increased from 37 in 1910 to 112 in 1915, an increase of 75, or 203 per cent.

The total number of fog signals, including sounding buoys, increased from 844 in 1910 to 1,044 in 1915, an increase of 200, or 24 per cent. Classified as to types, the increases were: Fog signals on shore, 498 to 527; whistling buoys, 104 to 149; bell buoys, 200 to 318; submarine bells, 42 to 50.

Although the number of aids to navigation steadily increased, as shown in the preceding paragraphs, involving an increase in all the operations of the service, it was possible to maintain this increased number of aids with a less number of lighthouse tenders, owing to the simplification of work and concentration of authority under the reorganization. Thus in 1910 there were 51 lighthouse tenders, in 1913 44 tenders and in 1915 47 tenders. With the considerable increase of 24 per cent which was made in the total number of aids to navigation, a gradual increase in tenders became necessary. Both for this reason and because of the necessity of replacing tenders as they are worn out in service, three tenders were being constructed and estimates accepted for others.

The number of light vessels and light-vessel stations diminished by a slight amount, two vessels and stations during the five years' period, the increase which might normally have been expected having been offset by the large increase in gas buoys, many of them equipped with whistles, bells and submarine bells, thus supplying important aids to a much larger number of localities and at much less expense than would have been possible with light vessels. There was, however, a steady construction of new light vessels to replace those worn out in service.

Typical of the more important aids which were established or materially improved during a recent year are: New light vessels with flashing lights and compressed air fog signals at Poe Reef, Straits of Mackenac, Lake Huron, Mich., and Buffalo Entrance, Lake Erie, N. Y. Both of these were former light-vessel stations which had been temporarily discontinued, one having been discontinued during 1915. New light and fog signal stations were constructed at Brandywine Shoal, Del., and Thimble Shoal, Va., in place of former structures. A complete new system of lighted aids was established at the approaches to the Cape Cod Canal, Mass.; important coast lights were changed from fixed to flashing or occulting in Alaska, Washington, Hawaii and Florida, while fog signals, electric bells, electric and automatic sirens, submarine bells, important gas buoys, flashing acetylene gas lights and systems of minor aids and buoyage were established, extensively rearranged or improved in important localities, all over the States and dependencies. The systematic inspection and relief of all buoys at least once a year is carried out throughout the service with a greater degree of completeness than in prior years, particularly in those districts where difficulties had been previously experienced on account of the large number of inaccessible buoys.

A systematic plan was developed of keeping records of extinguishments of various types of automatic gas lights, both on fixed and floating aids, with arrangements for reporting the percentage of nights extinguished as compared to the entire period under observation. This is believed to be useful in compiling information as to the comparative efficiency of various types in service and the degree of reliance which may be placed on such lights. Further improvements in publishing notices to mariners were undertaken during the year, by adopting a more concise form, giving only such facts as are of principal interest to the mariner. The light lists for the Atlantic, Lake and Pacific coasts were each issued in octavo form, which, it was believed, would increase their usefulness to mariners. Special effort was made to publish the seacoast light lists as soon after the first of the calendar year as possible, and the Lake list was issued immediately prior to the opening of the season of navigation.

During the five years from 1910 the organization and business methods of the lighthouse service were thoroughly examined and revised wherever it appeared advantageous to do so; 19 persons were appointed as civilian lighthouse inspectors, all selected solely on their technical qualifications; 15 of these were promoted in the Lighthouse Service, where each had served from 5 to 40 years, and the other four had had experience of from 8 to 13 years each on other government vessels engaged in related technical work. The two offices in each district were combined into one, and the office force and the use of the lighthouse tenders rearranged on a business basis. A general inspector and an examiner were appointed, who make periodic inspections of the technical and business methods in each district. A cost-keeping system for the whole service was inaugurated. The regulations and instructions were thoroughly revised. Annual conferences of lighthouse inspectors are held, and a monthly lighthouse bulletin is issued to the service. Aids and cadets have been appointed for training in lighthouse engineering and nautical work. The lighthouse publications have been simplified and systematized. Important economies and improvements have been introduced in the use and handling of supplies and accounting for property. The form of appropriations has been simplified. Full co-operation has been arranged between the Lighthouse Service and other branches of the Department of Commerce, other correlated bureaus of the government and maritime interests. Radio installations have been made on several tenders, and many improvements of apparatus have been perfected or introduced.

In securing increased efficiency and economy the welfare of the staff and assistants has also been constantly considered. Legislation has been secured providing for compensation for injuries received in hazardous work of the Lighthouse Service, the subsistence arrangements on vessels and the accommodations for crews have been improved, leave of absence has been granted to employees engaged by the day, a medical handbook has been published and the co-operation of the Public Health Service arranged for. A retirement system is also being persistently advocated for deserving employees who have earned this consideration.

LIGHTNING ARRESTER, a contrivance for guarding against passage of atmospheric electricity through electrical apparatus. The line wires are attached to a plate of brass, usually serrated on the under side. This plate rests on another plate connected with the ground, the two being separated by a thin layer of insulating material. See ELECTRICAL TERMS.

LIGHTNING AND LIGHTNING-RODS. Franklin in 1751 proved that lightning was simply a visible display of electricity — an extended spark; and until a generation ago little was added to his exposition to define the differentia of this phenomena. The origin of atmospheric electricity is believed to be simple friction. Faraday showed that a powerful current could be excited by steam-driven spray against a water surface, and the friction of wind-driven mist on the earth's surface may produce a great difference of potential between the latter and the upper air, possibly though not probably assisted by the friction on dust particles in the air. In any event, rain conducts a portion of it to earth; so that a period of dry weather causes a great accumulation of electricity, the particles of air distributing their charges through each other. This would make the earth and sky, in Lodge's comparison, the two coatings of a Leyden jar, but ordinarily the distance is too great for a spark to pass. The effect of electrical discharges on vapor, however, is to condense it into larger globules; this causes it to sink toward the earth as cloud, and the enormous tension relieves itself by passing from one cloud to another or to the earth or objects upon it, preferably projections of some height. If conduction through the cloud were instantaneous, it would be drained of its charge in one immense flash; but it being a poor conductor, several flashes at different points are common.

The discharge is determined by the tension of the air, the maximum of which without rupture is one-half gramme per square centimeter. If the rupture is local, there is no flash, but only a brush; but it is often the case that when the weakest spot has given way, a general breach follows for a long distance, sometimes miles, creating the flashes which pass either from cloud to earth or from cloud to cloud; and as the discharge of this portion draws the remaining current toward it, a second flash or set of flashes is made probable. But this analysis shows what experiment proves, that this flash is not a single discharge, but the successive discharges of a countless number of vapor particles or raindrops toward the earth or other electrified particles in the air, with such rapidity of progress that they seem simultaneous; since it is most improbable that if vast numbers of points gave way at once, they should all give way in the same line. It has been further proved by Prof. Ogden N. Rood that the flash is not a single sequence merely too swift for the eye to individualize; but although it lasts only a fraction of a second, it is itself composed of primary flashes in irregular sequence, each lasting but from a thousandth to a few thousandths of a second. This result was obtained by photography, which has invaluably supplemented laboratory experiment. By the latter, Prof. John Trowbridge has formed artificial flashes of lightning many feet long, made up of a combination of small discharges from a great number of petty cells. It had been long before proved by Joseph Henry that every electric discharge is an alternating or oscillating current, the periods of oscillation being only a few millionths of a second each and diminishing very rapidly in intensity; the entire duration depending on the magnitude and distance of the bodies. Hence it has been inferred that the small primary flashes are instances of these alternating discharges. Photography steadily tends to confirm these views.

Lightning according to its manifestations is divided into three classes. The "flash" or "stroke" lightning is the one had in mind when the name is used without qualification; it appears either as a sharp zigzag line of extreme brilliancy, or the same forked, but as more clearly revealed by photography shows a wavy line oscillating with enormous rapidity, or in tree shapes with endless branches, or ribbon shape, or in a mass of strands of close but distinct parallel flashes like unraveled rope, or still other shapes. Dark flashes in photographs are only photo-chemical decompositions on the plate. The second sort is sheet lightning, a sudden glow of a golden or reddish tinge on the horizon, with no definite shape or bounds. It is not usually an actual discharge in that form, the very genesis of lightning making it rare; but is the reflection of lightning flashes out of sight beyond the horizon, cast on the clouds or atmospheric haze, and visible sometimes for many scores of miles beyond the place of the actual storm which causes the flashes. A third is ball lightning, which for a long time was not admitted as a genuine form of electric discharge, and is still a very difficult and in some points unexplainable phenomenon. It has not been photographed, though something like it has been produced on a small scale in the laboratory. It is described as a ball or globe of brilliant light moving slowly a short distance above the surface of the earth, as if rolling on an invisible support a few feet high, and it has been said on occasion to float through an open door or window into a house, as though drawn in by a draft of air; it usually explodes, but without doing much damage. Under the head of lightning is sometimes included Saint Elmo's fire or corposant — jets and brushes of light seen not only at the tips of masts and yards of a ship in a thunderstorm, but on mountain tops, in hissing tongues of brilliant white and blue light several inches long.

The rope-strand lightning is not wholly accounted for; though there is general agreement that the first flash makes a rent or tube-like break in the air, along which succeeding discharges rush back and forth. Of the multiple flash, the explanation most conformable to laboratory experiment — where a spark between electrodes has been made to assume a like shape by blowing across it — is that the tube or opening does not close for a fraction of a second, and the wind, always violently present in a thunderstorm, moves the mass of air sidewise simultaneously enough to keep the tube intact for a moment. Another theory holds that the tube or break in the air closes up too quickly for this, but is so large that the alternate flashes appear side by side.

The thunder and the large raindrops accompanying lightning are well understood. The heat produced by the electric discharge traversing the atmosphere causes a sudden expansion of the particles next it, with a sharp compression of those beyond, in a great wave; on its passage the particles contract as suddenly, and the waves roll violently back, producing the noise of thunder. From the relatively slow passage of sound in the air and the increased and uneven refraction due to differences of temperature and wind movement, the thunder-waves very soon begin to rise and pass inaudibly overhead; so that it is rarely heard more than 15 or 20 miles off. The reason why the thunder follows the lightning usually at an appreciable interval is due to the fact that light travels so much faster than sound. When a flash occurs at the distance of a mile, the thunder is heard about five seconds later, and by noting the interval an observer can judge with considerable accuracy the distance of the discharge. Any flash of lightning within an eighth of a mile seems instantaneous with the thunder because the light persists and is retained in the vision for a short interval. The consolidation of the vapor into drops has been exactly imitated in the laboratory by electrifying spray, which causes the mist particles at once to begin aggregating in large globules. It has been shown that the mutual repellence of particles ceases as soon as a difference of potential is established by electrification, which substitutes a sort of suction around centres of force.

Protection from Lightning.— The annual destruction of life and property by lightning is very considerable; the former cannot be prevented to any great extent — though common-sense as to exposure can be instilled,— the latter could in part. In the United States during 1899, 563 persons were killed and 820 injured; parts of the Rockies and the upper Missouri Valley were the most dangerous. This rate, about 5 per 1,000,000, is larger than in other countries, from our great population of outdoor agricultural and ranching laborers. Fatalities are everywhere increased by the tendency to seek shelter from the rain when caught out in a storm, and these isolated shelters, as trees, barns, monument buildings in public parks, etc., are among the most liable to be struck. Statistics of buildings struck are in some respect significant, in others not detailed enough for utility. Thus, in Schleswig-Holstein during 1874-83, the annual average of strokes for wooden and thatched roofs was nearly two and one-half times greater than for slate or metal roofs, that for chimneys over 16 times as many even as the former, and that for windmills over one-third larger still. On the other hand, we learn nothing from the fact that in the United States during 1900, out of 1,847 buildings struck, 40 had lightning-rods, 855 had not and there is no report of 952, because not knowing what proportion of all buildings had them — probably a very small one — we have no percentages. On the other hand, it is notable that in nine years ending 1892, 2,335 barns, 104 churches and 664 dwellings were struck, and the larger fire-insurance companies have generally ceased insuring farm buildings. Isolated buildings in general were in five times as great danger as those in city blocks, perhaps partly because protected by metal cornices, etc. The Chronicle Fire Tables in 1902 recorded 3,012 fires in the United States caused by lightning, with a property loss of $3,397,000. This total is considered so small that since there has been no effort to gather the statistics.

Is it worth while attempting to protect buildings in general from lightning? Aside from the fact that we are never sure a building struck may not involve a loss of life, the matter resolves itself into a question of cost, and it is clearly demonstrated that it is not worth while. The problem was decided by the insurance companies some years ago. In the eight years 1885-92, in the United States, there were 3,516 fires from lightning, with a loss of $12,663,835, or a little over $1,500,000 a year The insurable part of this was nearly all insured and the practical question for property-holders is whether lightning-rods secure lower rates. Notoriously they do not. The companies make not the least difference in rates for "protected" buildings, as to insurability or rates, and the officials rarely put them on their own dwellings; the lightning-rod business is virtually extinct in this country. The public would, therefore, gain nothing by the outlay; except that with uninsurable isolated buildings, it would probably pay to enmesh them with metal points rather than undergo the risk. Of course also there are many cases where even a heavy expense ought to be incurred, as with buildings or their contents not replaceable with money — historic or noted architectural structures, museums, etc. But the fact remains that to reduce this $1,500,000 to one-third that amount would cost probably 50 times the saving in gross and several times the amount in yearly interest.

If protection is desired, however, it is fully proved that a great quantity of scattered metal points — whether iron or copper is immaterial, and iron is cheaper — is the most effective; a mesh of barbed-wire fence over the roof and chimneys would be not only the cheapest, but one of the most effective protections. The great steel buildings in New York City have all been struck time and again by lightning without damage. The numerous metal points and corners draw the electricity and it is promptly absorbed and distributed through the massive steel framework. Perfect safety is thus obtained by enclosing the building in a metal sheath, as no electric discharge can penetrate into an enclosed metal safe. The consensus of expert opinion now is that if a building is to be protected at all, numerous light iron rods are best, supported at a little distance from the structure and with numerous points. The old "conduit" theory of draining off the lightning and having a good conductor to prevent resistance and insulators to prevent jumping is now discarded: it is recognized that there is an enormous amount of electric energy to be discharged almost instantly, it is almost certain to distribute itself around a considerable area and all that the points can do is to ensure and regulate that distribution. If lightning-rods are used there should always be a good "ground" or "earth" at the bottom, as a ton of coke or a water ditch. The last statistics on lightning damage gathered and published by the United States Weather Bureau was in 1900, giving figures for the previous year, as nearly as they could be obtained. A total of 5,527 "strikes" were recorded, injuring 6,256 buildings. The property loss was a little over $3,000,000 and 4,251 head of livestock were killed, of a value of $130,000. Most of this latter was due to cattle contacting barbed wire fences in thunder storms. Consult Lodge's 'Lightning Conductors and Lightning Guards' (1892); and the report entitled 'Modern Lightning Conductors,' edited by Lodge, of the Lightning Research Committee of the Royal Institute of British Architects (1905).

LIGHTNING-STROKE. About five or six persons per million die annually from lightning-shocks. The effects of lightning-stroke on the body are similar to those produced by large amounts of electricity at high voltage. Persons subjected to the influence of lightning-stroke may suffer very slightly or may be killed, and between these extremes a vast variety of minor or major injuries may result. The most characteristic form of injury is some sort of burn. This occasionally shows on the skin as an arborescence, which was formerly thought to resemble the tree under which a patient had sought shelter during a storm, but is, of course, solely an effect of the zig-zagging of the electrical discharge. In many persons mental shock and prolonged nervousness are frequent symptoms. Mild stunning, with a sense of suffocation, may be experienced when an electrical bolt strikes near a person, and occasionally nervous and hysterical attacks are induced. Suppression of menstruation and abortion have been reported. Numbness and prickling of various areas of the body; paralysis of the muscles; deafness; loss of smell and taste; and paralysis of the bladder and rectum have all been described. Occasionally insanity has followed lightning-stroke. Other experiences of persons who have been exposed include flashing in the eyes, buzzing in the ears, general tremor, which may go on to convulsions, with or without loss of consciousness, and people who have been seen in this stage have been described as being blue, with muscles tightly contracted, the pupils dilated, the breath deep and snoring and pulse feeble. Since there are more than 30 deaths by suicide to one by lightning-stroke, it would seem wholly unnecessary for the average individual to worry over the likelihood of his earthly career being ended by lightning.

In death by lightning, changes in the nervous system have been found and it is probable that the cause of death may be either the result of minute hemorrhages, which take place in the important centres of breathing and of the heart-action and in the medulla; or death may be the physiological effect of the electricity on the heart, causing a form of heart-tetanus, with rapid cessation of the movement of this organ.

The treatment of lightning-stroke, as well as of other forms of electrical injuries, should be promptly instituted. If commercial currents are the cause they should be removed at once, care being taken to use insulating materials to remove live wires. External heat to the body with hot-water bottle, cardiac stimulation with whisky, ammonia, etc., with artificial respiration, should be simultaneously used.

No method of artificial respiration or other attempt to produce consciousness should be abandoned under three to six hours, as often no signs of life may be brought out in less than two to three hours. It is seriously advised by some observers that, before giving up all hope, an injection of an alkaline solution into the blood should be used. Hot saline solution may be thrown into the rectum and the treatment should be continued until all possible methods of resuscitation have been employed. Consult Jelliffe, 'Death by Lightning and Electricity' (in 'Text-book of Legal Medicine and Toxicology,' 1903); 'Death by Electric Currents and by Lightning' (in *British Medical Journal*, London 1913).

LIGHTON, William Rheem, American prose writer: b. Lycoming County, Pa., 13 July 1866. He was admitted to the Kansas and Nebraska bar in 1891 and has published 'Sons of Strength: a Romance of the Kansas Border Wars' (1899); 'Lewis and Clark,' in 'Riverside Biography' Series.

LIGNIN, the substance of wood-fibre, formed in part at least by conversion from cellulose (q.v.), and contained within the cellular tissue, giving hardness and weight to the woody parts of plants. Its chemical composition is not determined, but it is characterized by being soluble in weak alkalis and insoluble in water.

LIGNITE, a partially carbonized fossil wood, retaining its woody fibre and intermediate in its qualities between peat and coal. It is found in the Mesozoic and Tertiary strata, but chiefly in the latter. Much of the coal of the Gulf States, the Great Plains and Alaska is lignite. For description of lignite and especially for composition of American lignites, see COAL.

LIGNUM VITÆ, vī'tē. See GUAIACUM.

LIGNY, lē'nyē', a village in Belgium, province of Namur, nine miles northeast of Charleroi and 14 miles northwest of Namur. Here was fought the prelude to the battle of Waterloo on 16 June 1815. The Prussians were stationed at Ligny and the British at Quatre-Bras. Napoleon made a simultaneous attack on the two forces, striking at 84,000 Prussians under Blucher with his own 60,000. After a long and desperate struggle the Prussians were driven from the field with a loss of about 12,000. Napoleon lost 8,000 killed and wounded. Two days later came Waterloo (q.v.).

LIGUORI, lē-gwō'rē, **Saint Alfonso Maria de**, Catholic prelate, founder of the religious order called Redemptorists: b. Naples, 26 Sept. 1696; d. Nocera, Italy, 1 Aug. 1787. He was originally a lawyer, but became a priest in 1722, joined the Congregation for the Propagation of the Faith, instituted in Naples, and occupied himself as a missionary in the instruction of the ignorant peasantry. In 1732 he founded a monastery at Villa Scala, the members of which comprised the Order of the Most Holy Redeemer as it was called and were to be employed in the instruction of the people. This order, approved by Pope Benedict XIV in 1749, rapidly extended in Italy, Germany, Spain and France. Liguori was in 1762 appointed bishop of Sant Agata de' Gotici by Clement XIII, from which office he resigned in 1775. He was canonized in 1839 and in 1871 was declared a doctor of the Church. His 'Theologia Moralis' has appeared in several recent editions (Ratisbon 1881; Turin 1892; Genoa 1898) and there is a German edition of his letters (Ratisbon 1893, et seq.).

LIGURIA, lĭ-gū'rĭ-a, in ancient Greek and Roman geography that portion of northern Italy extending along the Mediterranean from the frontiers of Gallia Cisalpina to those of Etruria, bounded on the north by the Po, east by the Macra and west by the Varus. These were its limits at the time of Augustus, but at an earlier period it extended to the borders of Gaul, or even to the mouths of the Rhone. In 1797 Genoa received from Napoleon I a democratic constitution, under the appellation of the Ligurian Republic. This republic ceased to exist in 1805, when the emperor incorporated it with France. After 1814 it formed part of the kingdom of Sardinia and now of Italy, and comprises the provinces of Genoa and Porto Maurizio.

LIGURIAN REPUBLIC. See LIGURIA.

LIJA, a fish. See FILE-FISHES.

LILAC, a genus of ornamental, deciduous shrubs and trees (*Syringa*) of the order *Oleaceæ*. The species are characterized by opposite slender-stalked leaves and purplish or white and usually fragrant flowers in erect panicles. Nearly all the species which have developed many horticultural varieties are valued for park and garden planting, on account of their hardiness and free-blooming qualities. The common lilac (*S. vulgaris*) is a native of southwestern Asia, whence it was taken to Vienna during the closing years of the 16th century. It is probably the most widely planted of all the species. The wood of its larger specimens, which sometimes attain a height of more than 20 feet, is valued by cabinet-makers, for turning and inlaying. About a dozen species are cultivated in America. They do best in deep, rich soil, but will succeed almost anywhere; indeed, they are likely to become a nuisance from their habit of suckering, a habit taken advantage of for propagating purposes. Cuttings are also used, and some of the newer and choicer varieties are grafted upon ordinary lilac or upon privet stocks. During the closing years of the last century the plant came into vogue as a florists' flower, large quantities being forced for the winter and early spring markets.

LILBURNE, lĭl'bėrn, **John,** English sectary and political agitator: b. Thickney Puncharden, County Durham, about 1614; d. Eltham, Kent, 29 Aug. 1657. For putting forth tracts hostile to the Anglican Church he was whipped and imprisoned in 1637, but was released by the Long Parliament in 1640, and his conviction having been declared illegal and tyrannic, he received $15,000 indemnity. He then joined the army and rose to the rank of lieutenant-colonel. He was one of the party known as the «Levellers» (q.v.), and for his attacks on Cromwell and others was several times committed to the Tower. Having been exiled and having returned without leave, he was put in prison and tried for his life, but was acquitted although not liberated for some time. Subsequently he became a member of the Society of Friends. Hume describes him as «the most turbulent, but also the most upright and courageous of men.»

LILIACEÆ, lĭl-ĭ-ā'sē-ē, or **LILY FAMILY,** one of the most important orders of plants because of the uses made by man of many of its species, about 2,500 of which are comprised in nearly 200 genera. The characteristics of the group are monocotyledonous seeds; usually herbaceous stems which arise from bulbous, tuberous or rarely fibrous roots; generally narrow, simple leaves; and six-parted or toothed flowers, solitary or arranged in various ways, such as panicles, racemes, etc. In habit, many are adapted to deserts, some to ponds and streams, others are climbers, etc. Among those useful for food may be mentioned asparagus, onion, garlic, leek, chive, rocambole, shallot, camass and various species of lilies. A very large number of species are used for ornament; for example, lily, hyacinth, tulip, fritillary, lily-of-the-valley, tuberose, allium and yucca. Several species of *Xanthorea* and *Dracæna* yield useful resins; some of the genus *Chloragalum* furnish a substitute for soap; and certain species of yucca, sanseveria and of other genera yield valuable fibres. Isolated species of various genera have been used in medicine.

LILIENTHAL, Max, American rabbi: b. Munich, Bavaria, 15 Nov. 1815; d. Cincinnati, Ohio, 5 April 1882. Graduating from the university of his birthplace he was called to the directorship of a Hebrew school in Riga, Russia, and at government expense traveled through the 17 western provinces of Russia to encourage the Jews to make educational reforms. In 1842 this mission was ended and until 1845 he remained in Saint Petersburg, perfecting his educational system, when the Tsar Nicholas issuing orders which aimed at the conversion of the Jews to the Greek Church, he emigrated to America. On his arrival in 1844 he was made rabbi of three synagogues, but in 1850 resigned to establish a school. In 1855 he accepted a call as rabbi of the B'nai Israel Congregation of Cincinnati, a position he held until his death. He was foremost in civic and educational reform, an active member of the board of education and a director of the Cincinnati University. He was prominent in the councils of the Free Religion Associations and always championed the cause of progressive Indians with his voice and pen. He aided largely in the establishing of the Hebrew Union College and as an orator did much in his addresses in churches and on the public platform to promote social and religious reform.

LILIENTHAL, lē'lĭ-ĕn-tål', **Otto,** German aeronautical engineer: b. Anklam, Prussia, 23 May 1848; d. Rhinow, Prussia, 9 Aug. 1896. He studied at the Berlin trade school and then worked for Schwartzkopff and Hoppe at Berlin. Early in 1880 he founded a factory of his own, at which he made boilers, wrought-iron pulleys and sirens of his own invention. He also devoted himself to aeronautics and tried to solve the problem of flight by heavier-than-air machines. He invented the glider and made several successful glides, but met his death in an accident to one of his machines. He wrote 'Der Vogelflug als Grundlage der Fliegekunst' (Berlin 1889; tr. as 'Birdflight as the Basis of Aviation,' 1911); 'Die Flugapparate: allgemeine Gesichtspunkte bei deren Herstellung und Anwendung' (ib. 1894). See AERONAUTICS, HISTORY OF.

LILIS, or **LILITH,** a character in Jewish mythology. The Talmudists say that Adam had a wife before Eve, whose name was Lilis. Refusing to submit to Adam, she left Paradise for a region of the air. She still haunts the night as a spectre and is especially hostile to newborn infants. Some superstitious Jews still put in the chamber occupied by their wives four coins with labels on which the names of Adam and Eve are inscribed with the words «Avaunt thee, Lilith!» Our word «lullaby» is said to be a corruption of «Lilla, abi» (Lilith, avaunt).

LILIUOKALANI, lē-lē-wō-kä-lä'nē, **Lydia Kamekeha,** kä-mä-kä'hä, ex-queen of Hawaii: b. Honolulu, 2 Sept. 1838; d. 11 Nov. 1918. She was a sister of King Kalakaua and succeeded him in 1891. She was married to John O. Dominis, a native of Boston (d. 1891) who became governor of Oahu. She attempted to substitute a less liberal constitution for that of 1887, and this course resulted in her being deposed 30 Jan. 1893. The islanders then adopted a provisional government, which soon became a republic. She endeavored to secure assistance from the United States, visiting Washington in 1896 for that purpose, but on the annexation of Hawaii to the United States, in 1898, returned to the island. She revisited the United States in the winter of 1901–02 to press her claims for indemnity on the Crown lands, afterward residing in California and making a visit to Hawaii in 1914. See HAWAII.

LILIUS, Aloisius, author of the Gregorian calendar, originally called Aloigi Giglio. Nothing is known about him outside of his connection with the reform of the calendar and the fact that he was professor of medicine at the University of Perugia in 1552. He is sometimes mistakenly known as Luigi Lilio Giraldi. See CALENDAR.

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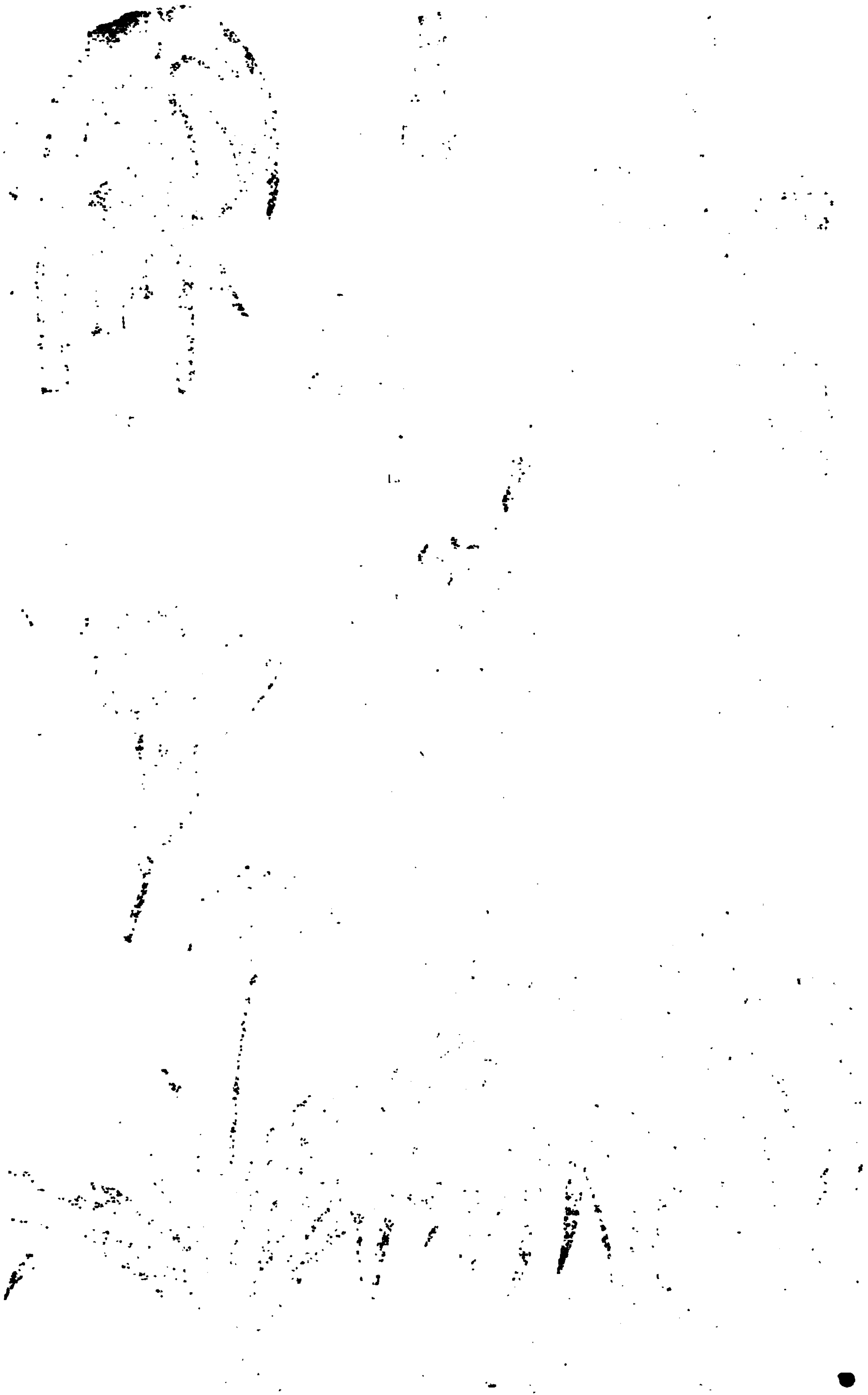

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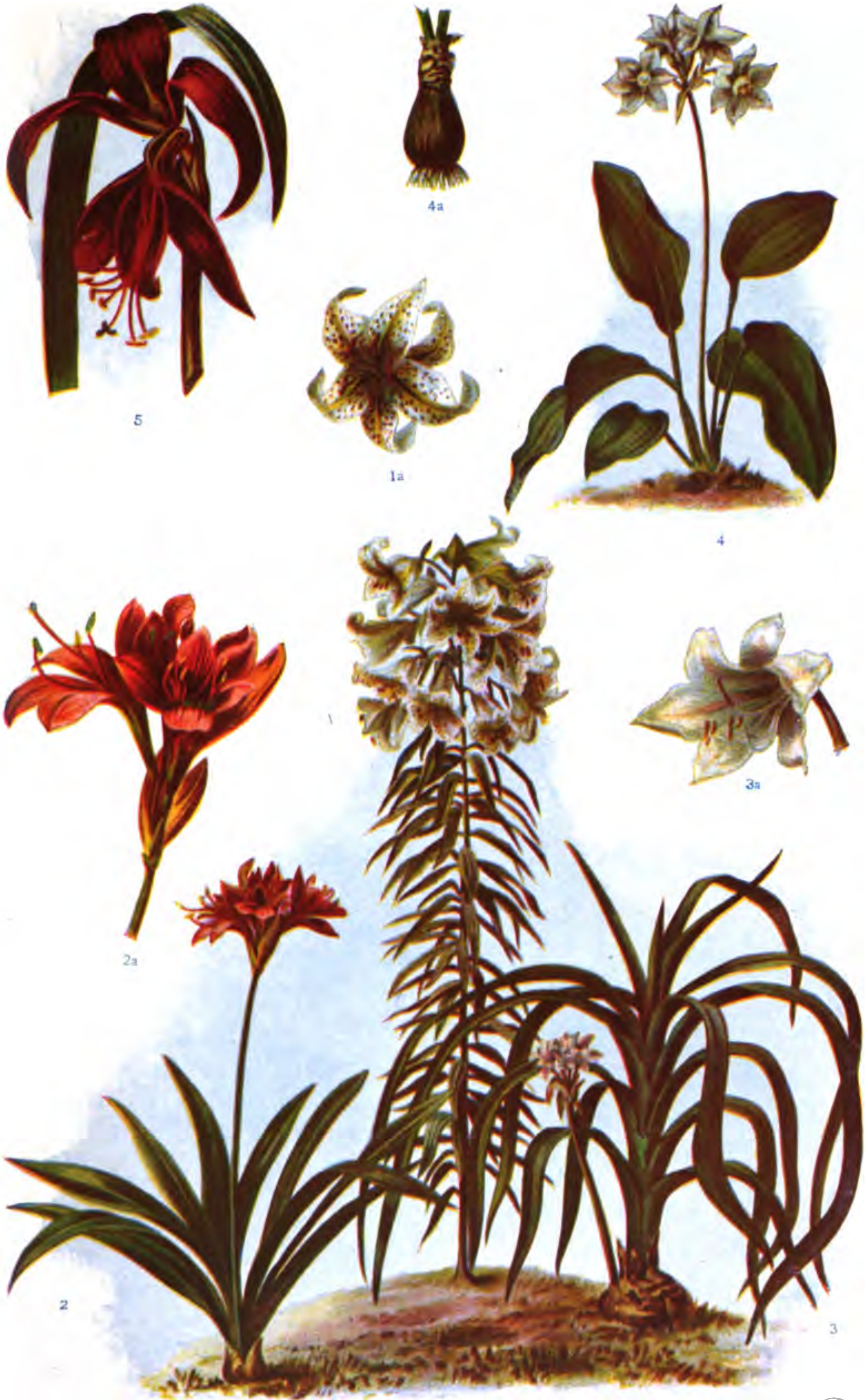
LILIUS, Aloysius. [illegible] Ferrara in 1582. [illegible]

LILIES AND AMARYLLIS



1. Golden Lily (Lilium auratum). 1a. Blossom, enlarged. 2. Garden Amaryllis. 2a. Blossom, enlarged. 3. Crinum scabrum. 4. Eucharis amazonica. 4a. Root-stock. 5. Jacob's Lily (Amaryllis formossima).

LILLE, lēl, France, an important town, capital of the department of the Nord and chief fortress of the north, 154 miles north of Paris and seven miles from the frontier of Belgium. It is well built and has spacious, regular streets, lined with large, massive houses. In the northwest of the town stands the citadel, a masterpiece of Vauban. New fortifications include a circle of detached forts. Among the churches are Saint Maurice, in the flamboyant style, recently restored; Notre Dame de la Treille, in 13th century Gothic; Saint Catherine; the Madelaine; and the Protestant Church. Among secular buildings are the Hôtel de Ville, with rich collections of pictures, drawings, etc.; the exchange (1652); the prefecture; the palace of justice; the arsenal; the Paris Gate, a triumphal arch in honor of Louis XIV; the general hospital; the theatre; and the concert-hall. Lille possesses a state university with four «faculties,» a Roman Catholic university, lyceum, communal college, school of art, conservatory of music, public library of 100,000 volumes, botanic garden, zoological garden, etc. The industries include cotton spinning and weaving, fine linen thread, linen and cotton twist, broadcloth, beet-sugar (raw and refined), soap, oil, ribbons, tulles, tobacco-factories, engine-works, foundries, dye-works, bleach-fields, breweries and distilleries. Its situation on the frontier and extensive railway and water communication made Lille a great entrepôt of trade. Lille is said to have originated in 1030, when Count Baldwin IV of Flanders fortified the little settlement around the castle of Buc. From this as a nucleus, the town grew rapidly until it gained communal privileges. Its history has been a stormy one. It was destroyed in 1213 by Philip Augustus, rebuilt by Joanna, Countess of Flanders, and was retaken in 1297. It was finally given to the king of France in 1312. It became a Burgundian possession through Margaret, wife of Philip the Bold, during which régime it grew in prestige. It fell into Austrian and then into Spanish power and was finally recaptured by Louis XIV of France in 1667. Captured in 1708, it was restored to France by the Treaty of Utrecht. The Austrians were unable to conquer it in 1792. In 1914, after a stubborn resistance by the allied English, French and Belgian armies, during which the city changed hands many times, Lille was captured by the Germans and a heavy tribute was exacted. See WAR, EUROPEAN.

LILLIBULLERO, lil″ĭ-bŭ-lē′rō, a political ballad that «sung James II out of three kingdoms.» A scurrilous attack on the Irish recruits, it is said to have been written by Lord Wharton in 1686 and the setting is ascribed to Henry Purcell.

LILLIPUT, lĭl′ĭ-pŭt, the name of a fabulous kingdom described by Jonathan Swift (q.v.) in ‘Gulliver's Travels,’ of which the inhabitants were not greater in size than a man's finger.

LILLO, lĭl′ō, **George**, English dramatist: b. London, 4 Feb. 1693; d. there, 3 Sept. 1739. The son of a Dutch jeweler, he was brought up to his father's trade, and was for several years in partnership with him. ‘Silvia, or the Country Burial’ (1730), a ballad opera, was his first piece; and was followed (1731) by the famous ‘London Merchant, or the History of George Barnwell,’ nowadays better known by its subtitle, which made its author famous, and held the stage for nearly a century. It had a marked influence in its day, and may be regarded as a precursor of the «domestic drama.» His other dramatic productions include ‘Britannia, or the Royal Lovers’ (1734); ‘Fatal Curiosity’ (1736); ‘Arden of Feversham,’ an adaptation of an Elizabethan play, revised or completed by John Hoadly after Lillo's death.

LILLY, lĭl′ĭ, **William**, English astrologer: b. Diseworth, Leicestershire, 1 May 1602; d. Horsham, Surrey, 9 June 1681. In 1632 he became interested in astrology, and two years later was associated with others in an unsuccessful search for treasure in the cloisters of Westminster Abbey. In 1644 he published the first volume of his almanac, ‘Merlinus Anglicus Junior, the English Merlin Revived, or a Mathematical Prediction upon the Affairs of the English Commonwealth,’ which appeared annually till his death. The king of Sweden sent him a gold chain and medal in 1659 in recognition of a favorable horoscope cast for him a short time before. He published many works, and was frequently engaged in controversy. His chief writings are ‘Christian Astrology, modestly treated in Three Books’ (1647), reprinted in 1852 by Zadkiel as ‘An Introduction to Astrology’; ‘An Astrological Prediction of the Occurrences in England for the Years 1648, 1649, 1650’ (1648); ‘Monarchy and No Monarchy’ (1651); ‘True History of King James I and King Charles I’ (1651); ‘Annus Tenebrosus’ (1652); ‘Anima Astrologiæ’ (1676); and ‘Catastrophe Mundi’ (1683). Butler satirizes Lilly in Hudibras under the name of Sidrophel. His autobiography was published in 1715.

LILLY, William Samuel, English controversial writer: b. Fifehead, Dorsetshire, 10 July 1840. He was educated at Cambridge and has been secretary to the Catholic Union of Great Britain from 1874. His works include ‘A Century of Revolution’ (1899); ‘First Principles in Politics’ (1899); ‘Essays and Speeches’ (1897); ‘A Year of Life’ (1900); ‘Renaissance Types’ (1901); ‘India and Its Problems’ (1902); ‘Studies in Religion and Literature’ (1904); ‘Many Mansions’ (1907); ‘Idola Fori’ (1910); ‘The New France’ (1913).

LILY. The type genus (*Lilium*) of the family *Liliaceæ* (q.v.). The several hundred well-marked species which have been described are succulent herbs with scaly bulbs and usually leafy upright stems terminated by solitary or variously grouped six-segmented flowers of very diverse colors and markings. In general, lilies are among the most popular of garden flowers, having held this position for centuries. But in the United States they have not taken the high rank that they hold in Europe, especially in Great Britain. This is probably due largely to the dryer, hotter climate, and the injudicious planting of the bulbs where they cannot long survive.

The various species and their varieties are adapted to a wide range of soils, a few, such as *L. tigrinum*, *L. canadense* and *L. superbum*, often succeeding in heavy land if well drained, and some, such as *L. washingtonianum*, *L. philadelphicum* and *L. concolor* withstanding the peculiar conditions of slaty ridges if deeply planted and well mulched during the growing season. But the greater number thrive best upon fairly rich, well-drained, deep, sandy loam, especially if sheltered from prevailing winds and the hot sun of midsummer. Not that the stems cannot stand sunlight; but the bulbs and roots should be cool and well but not excessively supplied with moisture and food. The bulbs should always be planted deeply, six inches or more, and the soil stirred to double the depth of planting. This not only assists in keeping the roots cool but protects the bulbs from excessive freezing, which seems to have some effect upon the vitality of shallow-planted specimens of even the hardiest species. Since vitality is also impaired by the exposure of the bulbs to the air, great care should be taken in transplanting to place the bulbs back in the soil as soon as possible after their removal. Transplanting is best done in early spring, the clumps being dug up, divided, the large bulbs planted in new, permanent quarters and the small ones and the bulb scales in nursery beds, where they should remain from one to three years, according to size when planted and to the species. One reason why bulbs obtained from seedsmen fail is because of undue drying. Orders for lilies should be given before the seedsmen can obtain the bulbs, and they should be filled by him without delay after the bulbs arrive. Often bulbs become so flabby from loss of moisture that they may fail to grow until the second year. Hence it is advisable to plant all but plump and turgid bulbs in a nursery bed, or where they may remain undisturbed for a year or two before being placed in permanent quarters. Propagation by means of seeds is slow in most cases; and many species rarely produce seeds in the United States.

The Bermuda Easter lily (*L. longiflorum*, var. *eximium*) is the only kind that is forced upon a commercial scale in the United States, though several other kinds are to be found in the principal florists' stores and in private conservatories. For forcing, the bulbs of this variety are planted as soon after their arrival from Bermuda as possible, generally before the end of September, and are kept in a cool, dark place until roots are well developed and the tops commence to form, when they are brought into the light, and by judicious management of heat are hastened or retarded to ensure their blossoming at desired seasons, especially Easter Sunday The management of other varieties used in greenhouses is more or less closely similar.

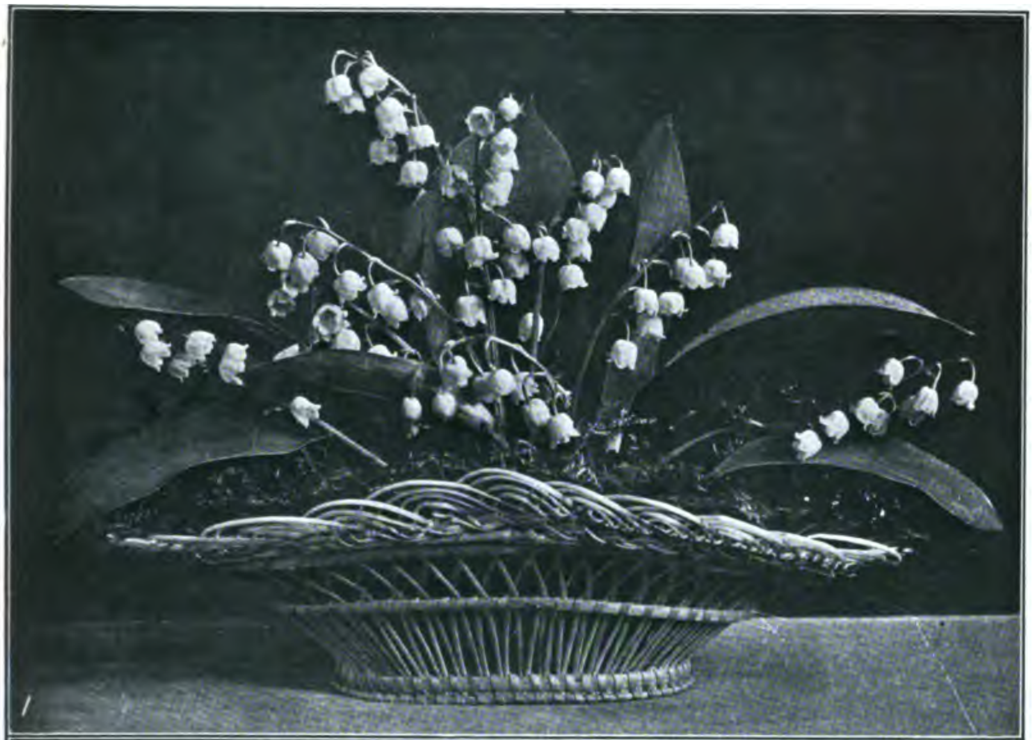
In general, lilies are most effective when mixed in small masses among shrubbery and hardy flower borders, the various kinds being sufficiently separated either in distance between the groups, or in season of blossoming, to avoid the clashing of inharmonious colors. Many of them have been used thus for ornamental planting, but though the great majority are well worth growing, scarcely a dozen have become widely popular in the United States, and of these not one is a native American species.

The following are probably the best-known species: Tiger lily (*L. tigrinum*), a Japanese species, often exceeds three feet in height and bears a loose raceme of sometimes a dozen nodding, dark-red, purplish-spotted flowers. It is a very hardy, useful species for the border, where it does best in masses. Madonna lily (*L. candidum*), a native of southern Europe, often attains three feet, bears from half a dozen to two dozen large, pure white, fragrant flowers in a raceme. It is a highly ornamental species, will do well upon sandy soils and in full sunlight. The Siberian coral lily (*L. tenuifolium*), which seldom exceeds two feet in height, bears from one to a score of scarlet, nodding flowers. Being very easy to propagate from seeds and bulb scales and of simplest culture, it is especially popular with beginners. Gold banded or Japan lily (*L. auratum*), which sometimes attains four feet, bears a few yellow banded, purple-spotted, white flowers in a short raceme. It is less persistent than the tiger and the showy lily, and somewhat less easy to cultivate, but is particularly useful for planting among groups of dark-colored shrubbery. Showy lily (*L. speciosum*), a Japanese species, often exceeds three feet, bears six or more white or pinkish, red-dotted flowers in a raceme. It is a specially hardy, thrifty and satisfactory species both for out-of-door planting and for greenhouse use. Next to the Bermuda Easter lily and *L. longiflorum* it is probably more widely grown by florists for cutting than any other kind. It has both white and red varieties. *L. longiflorum*, the original species of the Bermuda Easter lily, is forced in the same way as its variety. It is a native of Japan, from which country most of the bulbs are imported.

Besides the species mentioned the following are considered worthy of wide popularity: *L. chalcedonicum, elegans, testaceum, maximowiczii, martagon, maculatum, henryi, monadelphum* and *superbum*. These do well with little care upon ordinary light loamy soils. *L. canadense* and *superbum* succeed upon the same soils but require rather shady places. For cold climates even as far north as Ottawa, Canada, the following have proved successful: *L. brownii, wallacei, citrinum, croceum, melpomene, pardalinum, pomponium, dahuricum* and *batemanniæ*. The odors of *L. croceum* and *pomponium* are very offensive even in the garden, and when they are planted they should be at some distance from the house. Among the most fragrant are *L. longiflorum, auratum, candidum* and varieties. Consult Bailey, 'Standard Cyclopedia of Horticulture' (1916); Elwes, 'A Monograph of the Genus Lilium' (1880; *Botanical Gazette*, Vol. XXVII, p. 235, 1899).

LILY-OF-THE-VALLEY, a low-growing perennial herb (*Convallaria majalis*) of the lily family, with creeping rootstocks from which ascend radical leaves and little white or pink fragrant flowers arranged in racemes upon scapes. The plant being a native of western Asia is one of those popularly supposed to be referred to in the Sermon of the Mount, the tulip being another. It is a native also of Europe and of the mountains of the southeastern United States. The plants are perfectly hardy. They thrive in partially shaded, fairly rich loam, and may be readily propagated by means of the underground parts. Since beds are apt to run out they should be renewed every few years. The strong terminal buds known as pips are extensively used by florists

LILIES



1 Lilies of the Valley

2 Golden-Banded Lily of Japan

for forcing the flowers throughout the year. Several horticultural varieties have been produced, some with variegated or striped foliage, others with pink, variegated, or double flowers. A highly esteemed perfume, *eau d'or*, is made in France from the flowers; and the rootstocks have been used by druggists, but are less popular than formerly.

LILYBÆUM, lĭl-ĭ-bē'ŭm, the ancient name of Cape Boeo (q.v.).

LIM, a picturesque affluent of the Drina River, which rises on the northern slope of the Albanian Alps in Montenegro, between Bedavero and Priboy forms the boundary with Serbia, and after the first 30 miles of its entire course of 140 miles, flows beyond the border through Bornia to its junction with the Drina.

LIMA, lī'ma, Ohio, city, county-seat of Allen County, on the Ottawa River, and on the Erie, the Pennsylvania, the Cincinnati, Hamilton and Dayton, the Detroit Southern and the Lake Erie and Western and other railroads, about 70 miles north of Dayton and 80 miles south of Toledo. It is situated in an agricultural region and in the natural gas and petroleum belt of the State. The oil fields extend into six counties in the northwestern part of the State. The chief industrial establishments are locomotive and car works, machine-shops, petroleum refineries and railroad shops. The shipping trade is chiefly in petroleum, farm and dairy products and railroad car equipments. The city is the seat of Lima College, opened in 1893 under the auspices of the Lutherans. The city owns and operates the waterworks. The Ohio State Hospital for the Criminal Insane, one of the largest institutions of its kind, is located here. Pop. 33,904.

LIMA, lē'mä, Peru, South America, a department in the western part, on the Pacific Ocean; area, 13,310 square miles. It is mountainous in the east, but along the coast the land is low, and in the river valleys productive. A number of villages and towns are in the valleys. One of the principal agricultural productions is sugar. There are rich mineral deposits, but as yet the mines are undeveloped. Pop. about 300,000. The capital is Lima (q.v.) and the chief port, Callao, is, with a few miles of surrounding territory, now a separate department.

LIMA, Peru, South American city, capital of the department of Lima, on the Rimac River, seven miles from the Pacific. Callao, on the Pacific, at the mouth of the Rimac, is the port of Lima; it is connected with Lima by two railroads, one on each side of the Rimac. Another railroad extends from Lima to Concepción, a town on the eastern slope of the Andes. This railroad is in one place 15,000 feet above the sea. The city was founded by Francisco Pizarro, 1535, and named Ciudad de los Reyes, «City of the Kings,» because the site was chosen on 6 January, the feast of the «Wise Men,» or the «Three Kings.» It is about 500 feet above sea-level. The climate is unhealthful and dense fogs are prevalent. The city is triangular in form, and its streets are straight if narrow. Lima contains several promenades adorned with ornamental plants and statues and several notable plazas. The principal of these are the Plaza de Bolivar, the Plaza Mayo, and the Plaza del Acho with its bull ring. The exposition grounds form a fine pleasure garden and here are also zoological and botanical gardens. Lima's houses are in the Spanish style with the central *patio* and are mostly of adobe stuccoed with plaster. The cathedral, begun in 1535 and reconstructed in 1758, is the most notable building. There are about 70 other churches, some of architectural merit and several fine hospitals. Lima has considerable manufacturing industries including furniture, iron and copper articles, dyestuffs, pottery and is developing rapidly. The adobe walls which surrounded the city were destroyed in 1870, and boulevards made in their place. The city has long been famed for its educational institutions; the national university, chartered in 1551, is the oldest university in America. It has courses in theology, law, medicine, applied science, political science, art and music. The National Library, founded in 1822, with some books from older libraries, was destroyed in 1880 by the Chileans. It contained then 60,000 volumes. It now contains about 50,000 volumes. There are several other libraries in the city. There are several technical schools, professional, classical, naval and military, and about 100 elementary schools, besides a number of small private schools. Several scientific and literary societies provide public lecture courses. The city is noted for being the home of the first American canonized by the Roman Catholic Church, Saint Rose of Lima (1586). It has frequently suffered from earthquakes; the most destructive of which any record exists occurred in October 1746. The water supply and sewage system are good and the city is lighted by electricity. In Spanish colonial times Lima was the capital of the vice-royalty of Peru, which then included the greater part of Spanish South America. At the time of the war between Peru and Chile, Lima capitulated and the Chileans kept possession for two years. Many of its finest treasures and monuments were destroyed at this time. Pop. about 143,000, mostly Indian or mestizo. Consult Enoch, C. R., 'Peru' (London 1908) and Pradié-Fordéré, C., 'Lima ct ses environs' (Paris 1897).

LIMA E SILVA, Luiz Alves de, loo'ēs äl'vĕs, dā lē'mä ē sēl-vä, Duke of Caxias, Brazilian soldier and politician: b. Rio de Janiero, 25 Aug. 1803; d. Santa Monica, province of Rio de Janeiro, 7 May 1880. He became brigadier in the Brazilian army, was President of Maranhao, Vice-President and military commandant of Sao Paulo and President of Rio Grande do Sul; and in 1851–52 commanded the Brazilian army. In 1855 he became Minister of War; and from 3 Sept. 1856 to 3 May 1857 and again from 3 March 1861 to 4 May 1862 was Prime Minister. He commanded the army of Brazil against Paraguay in 1866–69, and from 25 June 1875 to 5 Jan. 1878 was a third time Premier.

LIMANTOUR, José Ives, Mexican statesman: b. Mexico City, 26 Dec. 1854. He was graduated from the National Preparatory School of Mexico City in 1871; and from the National School of Law in 1874, receiving his lawyer's diploma at the age of 20, after having successfully passed the required examinations, both in that institution and the National School of Jurisprudence. He traveled and studied abroad until 1876 and soon after his return to Mexico was appointed assistant professor and subsequently professor of political economy in the National School of Commerce, and still later professor of international law in the National School of Jurisprudence. In 1881 he was elected to the Mexico City council and afterward served several terms in the lower branch of the national Congress, of which he was several times presiding officer. During the 10 years prior to 1892 he served in various diplomatic and financial positions and was connected with the Department of Formento much of that time. In 1892 Mr. Limantour was appointed assistant Secretary of the Treasury and Secretary on 9 May 1893. During his administration many important financial reforms were inaugurated. In recognition of his public services he has been decorated by several foreign governments. He has written much on financial and other subjects.

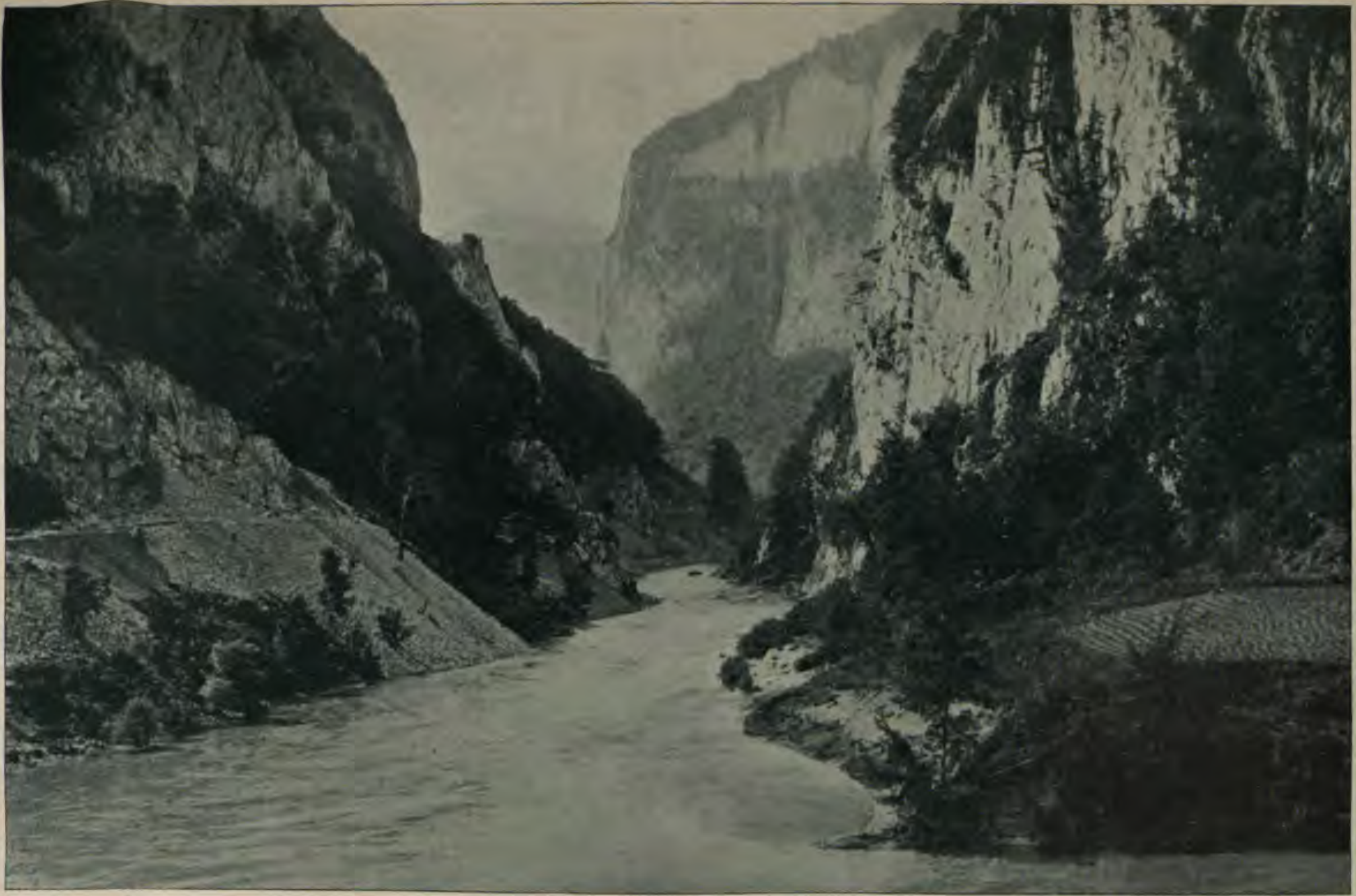
LIME, also known as caustic lime, quicklime or calcium oxide (CaO), is snow white in color and strongly alkaline, being one of the strongest bases. In contact with water, for which it has great affinity, it increases in bulk, evolves much heat and changes to the hydrate (CaH_2O_2). Unless kept in a dry place it will absorb moisture and carbonic acid gas from the air and change to the carbonate ($CaCO_3$) (see CALCIUM). Lime, except for certain impurities, is entirely soluble in water, the principal insoluble impurities being silica, alumina and iron oxide. It is never found native, but limestone may contain a very large percentage. For ordinary commercial uses lime is obtained by heating limestone, shells, or other material composed of calcium carbonate, to a temperature high enough to drive off the carbonic acid gas. As the materials used vary in purity, so is there a corresponding difference in the purity of the lime produced. Owing to its property of hardening, by change to calcium carbonate, and its comparative cheapness, lime is the most important of building materials. For commercial purposes the many varieties of lime are grouped into, (1) common or fat limes containing less than 10 per cent of impurities, (2) poor or meagre limes containing 10 to 25 per cent of impurities, (3) hydraulic limes containing 15 to 40 per cent of impurities and (4) hydraulic cements which may contain as high as 70 per cent of impurities.

Common or fat limes in slaking evolve much heat and increase in bulk from two and a half to three times; they are soluble in water. In hardening they shrink, and hence in making mortar require the addition of a large amount of sand. As fat limes are cheap and abundant and can take a large proportion of sand in making mortar, they are generally used for masonry. The poor or meagre limes are seldom used in this country. The hydraulic limes, so called from their property of hardening under water, though valuable for certain purposes, are also seldom used in the United States for masonry. They slake more slowly than ordinary limes with little rise of temperature and little increase in volume. Hydraulic cements (see CEMENT) do not slake and do not require the addition of sand to form mortar. They also set or harden much more quickly than ordinary limes, as the formation of calcium carbonate is a slow process that may under certain conditions take years, while in some quick-setting cements the formation of the calcium silicates and aluminates to which setting is due may take place in a few hours.

Limestone, marble and shells are burnt to lime by exposure to a temperature of 850 to 900° C. in a current of air. The harder the limestone the longer the time required for burning, but the better the product. Impurities in the limestone may or may not be injurious, depending on the quality of lime desired. Moisture in the limestone, or added to the charge, as by a steam jet, helps carry off the carbonic acid and hastens burning. Lime burning may be done in heaps or kilns. Heap burning in which pieces of limestone are piled on a grate of wood, then covered with fines or clay and fired, is now little used. Of kilns there are various types, intermittent and continuous firing. Of intermittent kilns the old «dug out» kilns built of ordinary brick on masonry into the side of a hill require about 72 hours for each firing. Heat is supplied by a coal or wood fire at the bottom. For continuous firing vertical kilns 20 to 25 feet high with draw openings, preferably below the fire line, are used, the lime being drawn about every six hours. To supply moisture, water is kept in an iron pan in the ash-pit. In the kilns most commonly used there is no grate, but the fuel, preferably charcoal or anthracite, is charged with the limestone. The lime is not as pure as from furnaces with a bottom grate, but the consumption of fuel per pound of lime made is less. In such kilns burning is started by partly filling the kiln with limestone, putting in a thick layer of kindling wood and coal, starting the fire, and then adding alternate layers of coal and limestone. The type of continuous kiln in most favor is vertical, about 25 feet high, bottle-shaped and made of boiler iron lined with fire-brick. Such a kiln may use petroleum for fuel, the oil being injected through openings in the wall just above the widest part of the furnace. Vertical kilns fired with gas have not proved successful. The type of kiln that requires the least fuel for amount of lime produced is the horizontal circular Hofman kiln, also used for making brick, drain, tile, etc. The fuel is fine coal or even coal dust, and is put in through openings in the top. The lime produced is lighter than that from vertical kilns, slakes more easily and hence cannot be stored as well.

Most of the lime made is used for building purposes, or mixed with clay for cement (q.v.), but lime is also used for making glass and artificial stone, as an agent in many chemical processes, as whitewash, and was formerly largely used in sugar-making to separate sugar from molasses. The statistics of the amount of lime annually made in the United States show that the value of the 1909 output was over $13,800,000; but at present the largest use of lime is in the Portland cement industry, which mines vast quantities of limestone, this being now the most valuable stone in the United States. See LIMESTONE; PORTLAND CEMENT.

Lime has some medicinal value, counteracting excessive acid conditions. Various preparations of limewater are recommended for dyspeptics and pregnant women. Mixed with milk it often reduces the tendency to vomit. Limewater with glycerine has been found useful in cases of creeping eczema. As an alkaline,



MOUTH OF THE RIVER LIM

lime has many uses in the arts and in chemical processes. It softens "hard" water; neutralizes acids, as in soils, and is indispensable in the making of sulphite for paper and gaseous ammonia. Consult 'The Mineral Industry' (New York 1916).

LIME, a shrub or small tree (*Citrus aurantifolia*), related to the citron (q.v.), resembling the lemon in habit but rather more prickly and spreading; its fruits, also, are more nearly spherical, more acid and rather more bitter than commercial varieties of lemon. It is a native of southeastern Asia, whence it has spread to other warm countries where its juice is highly valued for making cooling drinks. In Florida and the West Indies and Mexico, which supply the American market, large thickets of wild limes are to be found and these add to the crops from the cultivated groves. In California the lime is little cultivated because the cheapness of Mexican fruit prevents the realization of a profit from orchards. The lime is one of the most important sources of citric acid (q.v.). The trees are propagated, cultivated and trained much like lemon trees, but are planted closer together. They will stand poorer, stonier soil and nearer proximity to the ocean than other citrous fruits. The name is given in the Orient to various sour-fruited trees related to the true lime; in Europe and occasionally in the United States to the lindens (q.v.); and locally in the Southern States to the sour tupelo (q.v.), whose tart fruit is eaten.

LIME AS A FERTILIZER. See FERTILIZERS.

LIME LIGHT. See CALCIUM LIGHT.

LIMERICK, lĭm'ĕ-rĭk, Ireland, a city and civic county, capital of Limerick County, at the interior extremity of the estuary of the Shannon, 120 miles by rail southwest of Dublin. It consists of three portions connected by five bridges, English Town on King's Island, and Irish Town and Newtown Perry or New Town on either side of the river. Limerick is of very ancient foundation, being mentioned by Ptolemy as Regia. The principal buildings are the Episcopal and Roman Catholic cathedrals, custom-house, chamber of commerce, town-hall, exchange, assembly house and linen-hall. The manufactures include the curing of bacon, the preparation of butterine and the making of army clothing and fish hooks. There are, besides, distilleries, breweries, tanneries, corn mills, a patent slip for vessels of 500 tons, and a large graving dock for vessels up to 2,500 tons and a floating dock for vessels of 3,000 tons. Limerick is the leading port on the west coast for the shipment of raw produce. Bacon, butter, oats, salmon, condensed milk, are the chief articles of export and grain, petroleum and sugar the chief imports. Limerick is the seat of a consular agent of the United States. The harbor, naturally a fine one, has been improved at a considerable outlay. The strategic position of Limerick rendered its capture extremely important to the Danes, who arrived in the 9th century and practically founded the city and port. They held possession of it until the closing years of the 10th century when Brian Born weakened them sufficiently to exact a yearly tribute. It passed definitely to Irish hands after the rout of the Danes at Clontarf in April 1014. The Norman-English occupied the city soon after their arrival in 1172 and in 1210 King John visited it and erected fortifications. Edward Bruce led his forces against it in 1314 and while only partially successful burned a great part of the city. The Catholic party supporting Charles I against the Parliamentarians occupied Limerick in 1641 but were obliged to surrender to Ireton in 1651. In the Revolutionary War of 1688–91 Limerick was the scene of the last stand of the Irish forces under Sarsfield who supported the house of Stuart. After the disasters of the Boyne, Athlone and Aughrim, Sarsfield was besieged in Limerick by William's army under Ginkel. The defense was brilliant and successful, and after a train of siege artillery had been intercepted and destroyed by Sarsfield on its way to the city, an armistice was proposed by William, after which a treaty was signed under the terms of which Irish Catholics were to be permitted the free exercise of their religion, and those who so desired were permitted to leave the country. The greater part of Sarsfield's force immediately departed for France, where they formed the nucleus of the famous Irish Brigade. William's adherents soon forced him to violate many provisions of the treaty, particularly that granting to Catholics the free exercise of their faith, and an era of persecution was soon ushered in. In Irish history, Limerick is known as "the City of the Violated Treaty." The "Treaty Stone" marks the spot where the treaty was signed. Pop. 38,518. Consult Begley, J., 'Diocese of Limerick, Ancient and Mediæval' (Dublin 1906) and Lenihan, Maurice, 'Limerick: Its History and Antiquities' (2d ed., ib. 1884).

LIMESTONE, a common and widely distributed rock, consisting essentially of carbonate of lime and varying greatly in composition, color and texture. Most limestones are of organic origin and represent the calcareous remains of sea animals, such as corals, foraminifera and mollusks. These remains may be reduced to a fine ooze by the action of the waves and in other ways, and the rock resulting from the consolidation of this ooze may show no trace of organic origin. Some limestones have been formed by the precipitation of calcium carbonate from sea water through evaporation in confined estuaries. Other limestones (travertine, calcareous tufa) have been formed by the deposition of calcium carbonate from springs, while still others represent calcareous deposits in fresh-water lakes. The varieties of limestone are almost endless, including the crystalline limestones or marbles. Thus starting with nearly pure calcium carbonate, the calcium may be replaced gradually by magnesium till finally we have dolomite, the double carbonate of calcium and magnesium. Magnesian limestone is the proper designation until the ratio of calcium carbonate to magnesium carbonate becomes 100 to 84, beyond which it is dolomite. Pure dolomite contains 21.72 per cent of magnesia, but limestones containing over 5 per cent are said to be dolomitic. Again the lime may be replaced by silica, with a gradual transition from limestone through cherty limestone to pure cherts; or again iron oxide may replace lime with a resulting transition from limestone to merchantable iron ore. Besides these chemical transitions silicious or argillaceous sediments may be laid down with the calcareous material, and in the resulting rocks we may trace gradual changes from limestone through limy sandstones to pure sandstone and from limestone through marls or calcareous shales to ordinary shales. Bituminous matter may make limestone black or give rise to asphaltic varieties. Besides all these varieties of composition, limestones are often classified according to their texture, as earthy limestone, oölithic limestone with a concretionary texture, like the roe of fish, etc. Under rock stresses, with possible rise in temperature, limestone becomes recrystallized and is then known as marble. Chalk is a soft and powdery textured limestone. Limestones are also classified according to the uses to which they are put, and thus we have cement rock or hydraulic limestone used for making cement, lithographic limestone, statuary marble, etc.

The various limestones and marbles are widely used for building purposes, and a great amount of limestone is annually burnt to lime or to cement, though no statistics of the amount thus used are available (see Cement; Lime). Limestone is also used as a flux in smelting iron and other ores, the total amount thus used in the United States in 1902 amounting to fully 9,000,000 tons. Of the limestones used as building stone, particular mention may be made of the bluff or blue oölithic Bedford limestone of Indiana and of the marbles of Vermont, Georgia and Tennessee. Marble or limestone is also used as a source of carbonic acid gas for aërated waters.

The uncertainty of composition of a limestone deposit is a constant difficulty in utilizing it for cement and flux. It is a matter of common experience among quarrymen that to obtain uniform stone they must follow the beds of desirable composition, rather than to cut in straight lines. Limestone is found in horizontal deposits in successive layers, on what was once a sea bottom, and it varies in composition with depth. That which was laid at one period is most likely to be uniform, and this means quarrying along the strata selected, and also following what was formerly the shore line, if this can be determined.

Limestone is one of the most common rocks, and is found in almost every State and Territory of the United States. Being heavy for its value, it does not pay to freight it great distances, hence efforts are made to quarry it in various localities for nearby consumption. About 15 per cent of the area east of the Rockies bears limestone. Most of the New England limestone occurs in the form of marble, but deposits suitable for lime are found in large quantities in Berkshire County, Mass., and Litchfield and Fairfield counties, Conn. New York and Pennsylvania are both rich in limestone beds. There are extensive quarries near Buffalo that supply the blast furnaces. The Lehigh district of Pennsylvania contains immense quantities of cement rock and purer limestone beds. The valley of Virginia contains great deposits suitable for lime-burning, and easily accessible. This limestone belt extends across the corner of West Virginia, through Maryland into Pennsylvania. Calcareous rocks predominate in Tennessee, northern Alabama and northern Georgia. The greater part of the lime made in Wisconsin is burned from Silurian magnesian limestone found in the eastern part of the State. An extension of this belt of rock runs into Michigan. In Indiana the Bedford limestone, which is light gray, has attained a reputation as a building stone. Limestone is quarried in the southern part of Mississippi, and at intervals all the length of the Mississippi River. There is also a wide distribution in Missouri and Kansas, as well as Texas, Utah, Washington, Wisconsin, etc.

The total value of the limestone produced in the United States in 1909 was fully $32,000,000. See Calc-Tufa; Calcite; Chalk; Coral; Dolomite; Marble and Marl.

LIMICOLÆ, lī-mĭk'ō-lē, a group of birds, within the order *Charadriïformes*, containing the plovers, sandpipers, snipes, sheathbills, coursers, seed-snipes, stone-curlews, jacanas (qq.v.) and their immediate allies, most of which are known to gunners as «shore birds» or «beach birds,» because they haunt the shore of the sea or of inland bodies of water. They are mostly small, with slender bills of varying length, grooved for the nostrils, and in some families flexible at the tip, where nerves come close to the surface and enable the bird to feel about in the mud for its food. The legs are rather long, and the toes are ordinarily quite free, as these birds run about, and do not wade or swim as a rule; some, indeed, rarely approach the water, but dwell upon dry plains. The wings are strong and the powers of flight considerable; the most extensive migrations known are performed by some of the limicoline birds. All make their nests on the ground, and many breed only in the far north; the young run about as soon as freed from the shell. Light and pleasing, but not conspicuous, colors prevail, but some species display great beauty. Nearly all are edible and are the objects of skilful sport by the aid of dogs, decoys and other devices to overcome their wit and wariness. Consult Evans, ‘Birds’ (Vol. I, ‘Cambridge Natural History,’ 1900); Steineger, ‘Birds’ (Vol. IV, ‘Standard Natural History,’ 1885); Elliot, ‘North American Shore Birds’ (1895); Baird, Brewer and Ridgway, ‘North American Water Birds’ (1884); Sclater and Hudson, ‘Argentine Ornithology’ (1888); and general works on ornithology and shooting.

LIMINA. Among the most interesting phenomena of psychology are those that have to do with the relation between the intensity of a sensation and the intensity of the stimulus that excites it. It is found that it requires a certain definite amount of stimulus before any sensation whatever ensues. This is called the sensation-limen or lower threshold of sensation. Furthermore, even in the region within which the stimulus excites a sensation, an increment of the stimulus to produce a noticeable increment in the sensation must exceed a certain amount, known as the difference-limen. After a certain intensity of stimulus is attained no further increase in sensation-intensity can result. This is known as the terminal stimulus. According to Weber's Law, which is very nearly attained for moderate stimuli, the difference-limen for a given sense is a definite fraction of the intensity of the stimulus. Limina of exactly the same nature as those for intensity exist for the quality, duration, extension and probably for clearness (though this case has not been so thoroughly investigated), and have the same properties and obey the same laws as those for intensity. The domain of feeling is likewise subject to limina. For a discussion of the history of psychology work on limina and of the theories that have been put forward to explain their existence and for a bibliography, see Weber's Law.

LIMITATION OF ACTIONS, a legal limitation to the period within which actions may be brought, varying usually in the United States from 6 years or less to 20 years. The sound policy of placing a reasonable limit to the time within which actions might be brought was early recognized in the law, and among those who enforced this were the Romans, who looked upon it as a proper punishment for the person who failed to assert his rights. They qualified it, however, by exempting lunatics and minors under 14 years of age — an exception that is recognized, with some modifications, in modern codes. The difficulty of preserving evidence for a long time, the death of witnesses, the probability that old demands are bad ones, the necessity of obviating uncertainties in titles and claims, and the discouragement of long credits, are also given as grounds for placing limitations on actions. In English law, it was first adopted in the reign of Edward I by statute. Equity likewise recognized at an early period the justice of the principle.

By the weight of authority, actions for determining a status, and not to adjust claims against a particular defendant, are not limited. Examples of these are the validity of a marriage or other legal relation, the genuineness of a written instrument, or the like.

In actions on contracts not under seal, as a general rule, both in England and in the United States, no action can be brought after six years, and the time is computed from the time the plaintiff could legally have brought his action. In the case of a bill of exchange payable at sight, the time is computed from the date of presentment. In actions upon contracts under seal or actions affecting the title to real estate, suit must be brought within 20 years. Any part payment of the debt or interest thereon or a new promise to pay it operates to suspend the statute, but it begins to run again immediately after the part payment or new promise. The promise may be expressed or implied. It has been held that an unqualified acknowledgment of the debt will be considered in law an implied promise to pay. It is provided generally by statutes in the United States and Great Britain that the limitation will not run if the plaintiff is under disabilities, as coverture, minority, imprisonment, lunacy or absence from the country. Fraud of the defendant which prevents the plaintiff from asserting his right will also, as a general rule, prevent the statute from running until the plaintiff discovers such fraud. In actions of tort there is less uniformity in the statutes of the United States than in actions of contract as to the time when suit is barred. This varies in the case of torts from two to six years.

LIMITED LIABILITY, in modern statute law, a principle whereby the persons liable are bound under certain clearly defined conditions. The phrase is chiefly used in connection with stock companies, meaning that the stockholders shall not be called upon, under any circumstances, to contribute more than the par value of the shares of stock for which they have subscribed. If the debts of such a company, when wound up, amount to more than the resources of the company can meet, the creditors must bear the loss. In the United States shareholders in national and other banks, insurance companies, etc., are held to a specific and strict liability; in the case of the national banks, it is for twice the amount subscribed. In England the shareholders of a limited company from whose name the word «limited» is omitted must pay its debts in full. The United States Congress has adopted the rule followed by the British Parliament, and prevailing in European countries generally, with respect to the maritime law (q.v.) whereby a shipowner, by surrender of the ship and the freight, may absolve himself from liability for negligence on the part of master or crew. Under the amended United States Revised Statutes the principle of limited liability is clearly maintained and defined as applicable in this country; wherefrom it appears that «the owner of any vessel, whether steamer or canal-boat, employed whether in seagoing or inland navigation, whether he be an American citizen or a foreigner, may obtain a limitation to the value of his interest in the vessel and her pending freight, of his liability not only for the results of a single disaster, but for the results of a disastrous voyage, including all debts due on account of the vessel save seamen's wages.» If the ship and freight are lost, the owner must abandon all claims in regard to the vessel and cargo to the injured party. If he collects these he is liable to the injured parties to the extent of the proceeds. This limitation is confined to the owner of a vessel who is not in charge thereof and master and seamen are not exempted from liability if the injury is due to their misconduct. Consult Benedict, E. C., ‹The American Admiralty, its Jurisdiction and Practice› (New York 1898).

LIMITED MONARCHY. See Monarchy.

LIMITS, Theory of. See Real Variable, Theory of Functions of the; Series; Calculus, the Infinitesimal; Assemblages, General Theory of.

LIMNÆA, the central genus of the pulmonate family *Limnæidæ*, containing the typical fresh-water snails. See Pond-snails.

LIMNANDER DE NIEUWENHOVE, lĭm'nan-dėr dā nē'vĕn-hō'vĕ, Baron **Armand Marie Guislan,** Belgian composer: b. Ghent, 1814; d. Paris, 1892. He studied at the Jesuit College of Saint Acheul, near Amiens, later at Fribourg, and Fétis was his instructor in harmony and composition. He became conductor of an amateur symphonic society, and founded the «Réunion Lyrique,» a choral society, at Mechlin, where he started his career as a composer after his return from Switzerland. He published a ‹Stabat Mater› with orchestra, a ‹Requiem Mass› with organ, ‹Les Druides› operatic scenes, produced at the Paris Conservatory in 1845; ‹La fin des moissons,› a symphony; a ‹Te Deum,› a sonata for piano and violoncello, choruses for unaccompanied male voices and cantatas. He settled in Paris in 1847, and his opera ‹Les Monténégrins› was performed at the Opéra Comique in 1849. This was followed by 'Le château de la barbe bleue' in 1851 and 'Yvonne' in 1859. His 'Maitre-chanteur' presented at the Opéra in 1853 was revived as 'Maximilien' in Brussels in 1870.

LIMNO, LIMNOS, a name given to the island of Lemnos and also applied to the town of Kastro or Kastrow (q.v.).

LIMOGES, lē-mōzh, France, an episcopal city, capital of the department of Haute-Vienne, situated on a hill sloping to the Vienne, here crossed by three bridges, 88 miles west of Clermont. The streets are narrow and tortuous; but the fortified walls which surrounded the town have been replaced by fine shady boulevards. The principal edifices are the cathedral, commenced in 1273, presenting both Romanesque and Gothic features; the Gothic church of Saint Michel des Lions; the church of Saint Pierre du Queyroix; a modern town-hall, palace of justice, bishop's palace, public library of 90,000 volumes, school of decorative art, and meteorological observatory. It is the headquarters of the 12th army corps. The art of enamel is said to have flourished here from the 12th century, and the city is notable for a series of artists eminent for beautiful paintings in enamel. The principal industry is the manufacture of porcelain, begun in 1736, and employing thousands of workpeople; there are also wool and cotton spinning mills, paper mills, and shoe and clog manufactures. Book printing is of importance; a press was set up in 1496. It has a considerable trade in cereals, wine and spirits, wood and cattle.

Limoges was originally the capital of the Gallic tribe, the Lemovices, and an important city as the Roman «Augusboritum Lemocicum.» There are some remains of the Roman occupation inscriptions and other fragments. The city has been twice depopulated by pestilence, in the 10th century when 40,000 are reported to have perished, and in 1630–31, when 20,000 were taken. It was taken by assault by Edward the Black Prince in 1370, when a massacre of 3,000 of the inhabitants ensued. Pop. 92,181.

LIMON, lē-mōn', or **PUERTO LIMON**, poo-ār'tō lē-mōn, Costa Rica, Central America, a port on the northeast coast, 72 miles (103 by rail) east of San José, the capital at the eastern terminus of the interoceanic railway. The port has been greatly improved by modern docks and iron piers, and a growing export trade is carried on especially in coffee, also in bananas, rubber, mahogany, dyewood, etc. The town has ice factories, a brewery, a fine water supply and a modern sewerage system. Pop. 7,021.

LIMONITE, an ore of iron (q.v.), varieties of which are bog iron ore and yellow ochre. It is a hydrated oxide of iron ($2Fe_2O_3.3H_2O$), of a brownish color, occurring in mammillated or botryoidal masses, which when broken across show a fibrous radiating structure, and also in compact and earthy masses. It is opaque, rather brittle, moderately hard, and has specific gravity 3.6 to 4. It dissolves in warm aqua regia; when heated it loses water and becomes magnetic. It is an important ore of iron, and is found abundantly in the United States, especially in Virginia and Alabama, and in other parts of America; also on the continent of Europe, and in some parts of Great Britain. In 1914 the United States produced 1,537,750 long tons of this ore, that is, about 3 per cent of the total iron ore production. See also IRON ORES.

LIMPET, a gastropod mollusk, with a low, conical, non-spiral shell; properly a representative of the families *Patellidæ* and *Acmæidæ*. The former has no *ctenidia* or true gills, but breathe by means of a ring of special branchial filaments between the mantle and the foot; in the latter the left *ctenidium* functions as a gill and there is no accessory ring. By means of a muscular, sucker-like foot, the limpets adhere so firmly to rocks near low-water mark that they defy the beating of the heaviest surf and are difficult to detach without injury. At high-tide they move about in search of the algæ on which they feed, but are said to return to exactly the same place and position, the muscle in time wearing a smooth spot or «form» on the rock, and the shell becoming adapted to its irregularities. A widely distributed circumpolar species (*Acmæa testudinalis*) is common on the New England coast, and may be recognized by its low, conical, smooth shell with the eccentric apex slightly turned forward. In Europe limpets are utilized as food and in this country for bait. The key-hole limpets belong to the family *Fissurellidæ*, in which the shell is usually perforated like a key-hole at the apex to permit the protrusion of a process of the mantle. Numerous species occur in the littoral zone of warm seas. The *Haliotidæ*, ear-limpets or abalones (q.v.), are closely related. The cup-and-saucer limpets and slipper-limpets (*Calyptræidæ*) have flat shells usually provided with an internal lip or shelf. Several species of *Crepidula*, having interesting commensalistic habits, are abundant on our coasts, and are known to fishermen as «half-decks.» Finally the fresh-water limpets (*Ancylus* and *Gundlachia*) belong to the pulmonate family *Limnæidæ*. Numerous species of these true air-breathing limpets are found abundantly on stones and plants in the fresh-water streams and ponds of the United States. They feed on confervæ. Limpets, especially *Acmæa* and *Patella*, are of very ancient race, having existed almost unchanged since the Silurian Age. Consult Cooke, «Molluscs» ('Cambridge Natural History,' Vol. III, London 1895); 'Standard Natural History' (Vol. I); Arnold, 'Sea Beach at Ebb-tide' (New York 1901); Mayer, 'Sea-shore Life' (New York 1906).

LIMPKIN, a crane-like bird of the swamps of tropical America, known and superstitiously feared by the ignorant natives on account of its sombre plumage and wailing cry. Two species exist, *Aramus scolopaceus* and *A. pictus*.

LIMPOPO, lim-pō'pō, or **CROCODILE RIVER**, South Africa, a river which rises to the south of Pretoria in the Witwatersrand, flows northwest through the Transvaal, then northeast, forming for a considerable distance the northern boundary of the Transvaal province, then southeast into the Indian Ocean north of Delagoa Bay; length about 1,100 miles. Its largest tributary is the Olifants, which flows through the Transvaal and joins it in Portuguese territory.

LINACRE, lin'a-kėr, **Thomas**, noted English physician and scholar: b. Canterbury, England, 1460; d. London, England, 20 Oct. 1524. He was the projector of the College of Physicians in London and the founder of lectureships in both Oxford and Cambridge.

LINARES, José María, hō-sā' mā-rē'ä lē-nä'rēs, Bolivian statesman: b. Potosí, 10 July 1810; d. Valparaiso, Chile, 1861. He was admitted to the bar, was appointed one of the commissioners to prepare a legal code for Bolivia, in 1839 became Minister of the Interior, later Minister to Spain, and in 1848 president of the Senate. In 1857 he was chosen President, but was deposed by revolutionists in January 1861.

LINARES, Chile, (1) a southern province bounded north, south and west by the provinces of Talca, Nuble and Maule, and on the east by the Andes; area, 3,942 square miles; pop. 112,566. Its surface is mountainous, but there is a large acreage well adapted to grazing. Stock raising is the chief industry. A railway, one of the main arteries of Chile, traverses the province from north to south. (2) A town, the capital of the above province, 10 miles southeast of Talca, 55 miles from the coast and about 85 miles north by east of Concepción. It has a large trade and is the distributing centre for the commerce of the province. It is reached by rail from Santiago. Pop. 11,122.

LINARITE. A basic hydrous lead-copper sulphate $\mathrm{PbO.CuO, SO_3. H_2O}$. in Cerro Gordo mine, Inyo County, Cal., and Silver Horn mine, Beaver County, Utah.

LINCOLN, Abraham, 16th President of the United States: b. in a rude farm cabin near Hodgensville, Ky., 12 Feb. 1809; d. Washington, D. C., 15 April 1865. The birthplace is marked by a memorial structure dedicated on his hundredth anniversary. He was the first son and second child of Thomas Lincoln and Nancy Hanks, both born in Rockingham County, Va., of parents who were among the earliest emigrants to the new country beyond the mountains. They were married in Washington County, 12 June 1806, at the home of Richard Berry, guardian of the bride and husband of Lucy Shipley, her aunt. Thomas was not yet six when his father, Abraham, was killed by lurking Indians while he was at work on his farm. The estate, mostly of wild land, descended by the existing law to his eldest son. No account remains of the widow's subsequent life. Probably she did not long survive the tragedy. Thomas grew up utterly without education and apparently without a definite home. Principally occupied as a farm and forest laborer he acquired some knowledge of the tools and trade of a carpenter. For reasons not uncommon in the lives of families separated by distant migrations the President had little knowledge of his forbears beyond the paternal grandfather. Long after his death it transpired that the first American progenitor was Samuel Lincoln who came from England as a weaver's apprentice in 1637. Two elder brothers had previously settled at Hingham, Mass.; named after the English shire town of County Norwich, their ancestral home. Samuel joined them there after completing his apprenticeship at Salem. Neither of the brothers left issue, the name being perpetuated through Mordecai, son of the young weaver; Mordecai 2d, his grandson; John, a great-grandson who lived for a time in Berks County, Pa., removing to Virginia; Abraham, the Kentucky pioneer; and Thomas, fifth in the order of American birth. The pedigree has been further traced through four generations in England. In both the old home and the new the main and converging lines of heredity gave promise of family distinction should time and occasion propitiously meet. It was mistakenly believed for a time that Thomas and his wife were first cousins. She was the daughter of Joseph Hanks and Nancy Shipley ("Nanny" as named in the husband's will), who was a sister of Lucy Shipley, wife of Richard Berry before mentioned. Another sister, Mary by name, had married Abraham Lincoln the elder, and it was assumed that she was the mother of all his children. In fact, however, Mary Shipley died prior to the Kentucky migration and was succeeded by Bathsheba Herring, daughter of Leonard Herring, a Virginian of English parentage. Thomas was the son and only child of this second marriage and therefore unrelated by blood to Nancy his wife. It is worthy of passing mention that still another of the Shipley sisters was married to Thomas Sparrow and went with him to the Kentucky wilderness. Through the marriage of their daughter with one Charles Friend she became the grandmother of Dennis Friend who somehow came to be known as Dennis "Hanks"; and was no credit to either name. The irresponsible chatter of this waif did much to mislead the biographers both as to the story of Lincoln's youth and the Hanks genealogy. (Consult Lea and Hutchinson, 'The Ancestry of Abraham Lincoln,' Boston 1909). The first home of Thomas and his wife was at Elizabethtown, Ky., where he pursued his trade as carpenter. Two adventures in farming ensued, the first on the Nolin Creek place where their famous son was born. A second son, also born there, lived but a few weeks. Upon neither farm apparently were payments made sufficient to create a salable interest. In 1817, several related families accompanying them, they moved to Indiana, settling on a wooded tract near Gentryville in Spencer County; so named after the keeper of a cross-roads store. A railroad junction point called Lincoln City occupies a part of the chosen homestead. In October of the following year a mysterious epidemic swept the district, Mrs. Lincoln being one of many victims. During the next 14 months, the daughter, but two years older than Abraham, kept house for the sorrowing family. On 2 Dec. 1819, Thomas took another wife from Kentucky, Sarah Johnston (*née* Bush), a widow with three children residing at Elizabethtown. Her advent greatly improved the family circumstances, for besides household conveniences such as the children had never known she brought a kind and cheerful nature. Among other benefits conferred she encouraged the boy in studies, which his father regarded as a form of idleness. Less than a year of school attendance is all that fell to his lot, but with this meagre help he learned to read and write and to "cipher to the rule of three." Luckily there were a few good books within reach, all of which he eagerly read. He remembered well, thought much and diligently exercised the knowledge gained. In other respects he was a boy among boys, loving fun and not enamored of manual toil. He was made to work at home or on the neighboring farms, clerked at odd times in Gentry's store and at the age of 19 accompanied the son of that worthy on a flat-boat trip to New Orleans, trading along the way and returning by river packet. On that memorable venture he first came into conscious contact with slavery, witnessing, it is said, an auction sale of negroes and vowing that if ever the opportunity came to «hit» that system he would «hit it hard.» In the spring of 1830 at the beginning of his majority the family moved to Illinois to settle (temporarily as it proved) near Decatur. After helping to fence and break up part of a prairie farm and to erect a cabin thereon for the family shelter the young man turned to face the world on his own account. Besides the clothing he wore, he had nothing but his well-muscled frame of six and one-third feet in height, a mind matching his great stature in native strength and manners, rude and quaint, to be sure, but springing from a brave and generous soul. After a few weeks of labor with axe and hoe he engaged with John Hanks, one of his mother's tribe, to conduct another flat-boat down the great river. Their employer, Dennis Offut, had failed to provide the boat as promised whereupon the two men proceeded to build one. The delay caused Hanks to abandon the voyage but Lincoln with other help completed it. Offut, a merchant, loosely planted at New Salem, on the Sangamon, near Springfield, formed a liking for the stalwart youth, with the result that Lincoln became a resident of the mushroom village and a helper in the varied and often disastrous enterprises of his new-made friend. Offut soon drifted away but Lincoln remained, serving the small community as a mill-hand, clerk in the village stores, postmaster, deputy surveyor and the like, rapidly growing in public esteem. Indian disturbances (the Black Hawk War) called for the creation of a military force. Lincoln volunteered as a private and was elected captain. No fighting occurred in his vicinity and the «war» soon ended. Returning to New Salem he became a candidate for the legislature, failing of election but receiving nearly the entire vote of his precinct. Settled in nothing save the desire for self-improvement, he ventured, with another as poor as himself and wholly on credit, to purchase a failing store. It continued to fail till only the debt remained. This burden, which he whimsically called «the national debt,» fell upon himself alone and was not fully discharged until his pay as Congressman at last provided the means. To business disaster was added the discipline of love and a lover's bereavement. He wooed and won Ann Rutledge, who shortly after the engagement died of a sudden illness. She was one of the Southern family of Rutledges, her father having been caught with the rest in the New Salem eddy along the inflowing stream of settlers. He was so nearly unmanned by this blow that his friends were alarmed, but it passed. By the election of 1834 he was sent to the legislature and was thrice re-elected. Largely through his efforts the State capital was removed from Vandalia to Springfield in his own county. Measuring himself against his fellows, many of them lawyers, he dared to enter the bar. With no help except from borrowed books, he had so far advanced by the autumn of 1836 as to gain admission. On 15 April of the following year he moved to Springfield and engaged in the practice. That day 28 years later, at the summit of national power and fame, an assassin's shot was to lay him low.

In politics the young statesman was of the minority faction. The Democratic party was dominant in both his State and the nation, such opposition as there was holding loosely together under the nondescript name of Whigs; but it gradually strengthened until in 1840 its presidential candidate (Harrison) was elected. In 1838 and again in 1840 Lincoln received the Whig vote for speaker of the assembly. He was also on the Whig electoral ticket in the campaigns of 1840, 1844 and 1852. His one election to Congress occurred in 1846, the term ending at the inauguration of the second Whig President (Taylor) 4 March 1849. He did not seek re-election, his district being governed by a kind of a «gentleman's agreement» that the honor should be passed around. Meanwhile (4 Nov. 1842) he was married to Mary Todd, daughter of Robert S. Todd of Louisville, Ky. She with two of their four sons lived to mourn his untimely death. One of the sons died in early infancy, another in the White House at the age of 12. Mrs. Lincoln was of high social rank, brilliant, cultured and ambitious. She proved a devoted wife and mother, but by reason of a cerebral ailment not generally known her married life was not altogether happy. Her last days (1882) were clouded by a mild insanity, hastened no doubt by the awful tragedy enacted in her presence and by the loss of her young son Thomas («Tad»), who died 15 July 1871. The political activities referred to of course retarded Mr. Lincoln's progress in the law. Besides the legislative attendances at home and in Washington, there were repeated canvasses of his district and State to be cared for and no end of letters and conferences. As a «case» lawyer, however, his reputation steadily widened. The death of President Harrison almost at the beginning of his term and the early apostacy of Tyler, his successor, left nothing of Federal preferment to the Whig politicians. The advent of Taylor opened the door to a hungry crowd. Lincoln had supported him by speeches in Congress and elsewhere and the new Congressman from the Springfield district was of the opposite party. By current practice, therefore, Lincoln was entitled to a voice touching Federal appointments. The office of land commissioner was accorded to Illinois. After recommending others without success he sought the place for himself. Instead he was offered the governorship of Oregon Territory, a post which seemed to promise early promotion to the Senate. His wife rejected it and thus he was saved for greater things. During the next five years he practised law more assiduously than every before, advancing to high rank among the leaders of the Illinois bar. He appreciated the handicap of a defective education and strove mightily to overcome it. As he had studied grammar and surveying at New Salem he now grappled geometry, in order as he said to master the art of «demonstration.» But political events were soon to reclaim his attention. The controversy over slavery, measurably quieted by the Missouri Compromise of 1820, broke out afresh 30 years later and was again partially suppressed through a series of Congressional acts

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known as the compromise measures of 1850. Within a short four years the slave-holding South demanded and obtained the overthrow of all legislation which tended to confine or discredit her favorite institution. Stephen A. Douglas, the leading senator from Illinois, was chairman of the Committee on Territories. He had championed the settlement of 1850, and in doing so had proclaimed undying allegiance to the Missouri Compromise whereby «Mason and Dixon's Line» was made the northernmost limit of slavery. Now he had fathered the «Kansas-Nebraska bill,» the act which both in terms and by necessary implication rejected the compromises and denied their legality. His agency in the matter made the storm of protest especially violent in Illinois and Lincoln was thoroughly aroused. Douglas had great ability and towering ambition. He desired and expected to be President, having already contested the nomination of 1852. His advocacy of the repeal was likely, he believed, to ensure undivided support in the South which, with but a fraction of the Northern party strength, would give him the prize. His term in the Senate had yet four years to run but his colleague and friend from Illinois, James Shields, would be re-elected or replaced by the legislature shortly to be chosen. Lincoln entered the contest with vigor, speaking throughout the State and (against his own preference) standing for election to the lower house from Sangamon, his home county. «Anti-Nebraska» won by a slender margin and by general acclaim Lincoln became its candidate. To avoid a legal quibble touching eligibility he resigned his membership, only to see the vacancy filled by a Democrat chosen at a special election. Five of the majority, formerly Democrats, refused to support him, preferring Lyman Trumbull, one of their kind. After many ballots, the choice of a pro-slavery senator being imminent, he persuaded his friends to vote with the stubborn few; a fortunate outcome as it proved, though for the moment sorely disappointing.

The events of 1854–55 thus lightly sketched were accompanied and followed by a bitter struggle for the control of Kansas, first of the new States to seek admittance. Settlers from the North, some of them aided by anti-slavery societies, were met by «border-ruffians» so-called, entering from Missouri. Armed conflicts ensued and «Bleeding Kansas» became an effective war-cry from the free State hustings. The Democratic National Convention (1856) again rejected Douglas, naming James Buchanan, a Pennsylvanian, who was less prominent in the slavery party and therefore less obnoxious to its enemies. The various opposing elements drawing together under the name of Republicans met in mass convention at Philadelphia and selected John C. Frémont as their standard bearer. Lincoln, though not in attendance and not in the least advised of any such purpose, was accorded 110 votes for the Vice-Presidency, making him the second choice in a field of 13. A third ticket, styled «American,» was headed by Millard Fillmore, who had become President upon the death of Taylor (1850), and greatly desired re-election. Buchanan was elected, carrying every slave State except Maryland. Pennsylvania supported him by a bare majority of the popular vote, and three other free States, including Illinois, went to him, but only because the majority was divided between Frémont and Fillmore. Slavery was continued in official power, but the triumph was big with disaster.

The new administration was wholly subservient. Unscrupulous efforts to force slavery upon unwilling Kansas were favored and seemed likely to succeed. Douglas, whose senatorial term was drawing to a close, could not lose his hold upon Illinois without abandoning all hopes of the Presidency. Making a virtue of necessity, therefore, he resisted the Kansas intrigues, and the State came in with a free constitution. This strategy worked marvelous improvement in his prospects at home. In 1854 when he returned red-handed from the slaughter of compromise he had encountered public obloquy and sullen resentment, resulting as already noted in the choice of a colleague inimical to his party. Now he came as the hero of a knightly rescue; the savior of free Kansas in some eyes, to others a stern defender of justice unshaken by personal risk. Republicans in and out of the State began to advise that his re-election be not opposed, deeming it «good politics» thus to promote schism in the enemy's household. Lincoln moved promptly to steady the Republican phalanx and the danger soon passed. Partly to head off the threatened defection, in part to bind the new legislature by a definite mandate from the people, a convention called for the nomination of State officers named Lincoln for the Senate. He responded (16 June 1858) in a speech which exhibited at their best both his intellectual power and his rare facility of terse and accurate expression. In this, the much-quoted «House-divided» speech, the truth was first made plain that choice must be made, soon or late, between a nation all slave and a nation all free. In declaring his fixed opinion that «either the opponents of slavery will arrest the further spread of it, and place it where the public mind shall rest in the belief that it is in the course of ultimate extinction; or its advocates will push it forward till it shall become alike lawful in all the States,» he was by no means unminded of the personal and party hazards immediately involved; but with habitual thoroughness his mind had gone deep. To his thinking the rock upon which his party must build was the basic antagonism between freedom and bondage, between liberty and tyranny, between right and wrong. Rejecting the warnings of timid advisers to whom the address was submitted in advance he stood by the truth as he saw it. The ensuing campaign, outwardly but a mere struggle for office, drew the lines and marshaled the forces of the impending Civil War. It took the form indeed of mimic battle. A series of joint debates, one in each of the seven Congressional districts, was arranged at Lincoln's instance. Vast audiences came to hear and the speeches stenographically reported were carried far on the wings of the press. The two champions were not unequally matched for the contest. Douglas, of course, had signal advantages in long parliamentary training and national fame. He was fluent, aggressive and courageous even to recklessness, with a quick eye to exposed points of attack. But as compared with Lincoln he was in truth the «little giant,» with emphasis on the first branch of his familiar sobriquet. Lincoln, the taller by eight inches or more, was of corresponding intellectual reach. Less voluble, less gifted in voice and exterior attractiveness, he was more thoughtful, better tempered, surer in his knowledge of the history involved and far above Douglas in the saving quality of humor. His own estimate of the comparative merits of their speeches was expressed late in the following year when he caused both to be reprinted side by side, for campaign purposes, without change and «without any comment whatever.»

The State was carried on the popular vote, but the existing apportionment gave the advantage to Douglas who was returned to the Senate by a majority of five. Commenting upon the outcome Lincoln wrote 19 November, «I am glad I made the late race. It gave me a hearing on the great and enduring question of the age, which I could have had in no other way; and though I now sink out of view, and shall be forgotten, I believe I have made some marks which will tell for the cause of liberty long after I am gone.» But he was not to be lost from sight or memory. The great debate continued on a wider field. He was called to speak in other States and finally (27 Feb. 1860) by a masterly address at Cooper Institute, in New York City, the growing impression of his leadership was greatly extended. But there were few to think of him then as a possible chief magistrate. The national convention was to meet within the next 80 days (16 May 1860) and it was the general belief that Senator William H. Seward of New York would be the Republican nominee. Fully two-thirds of the delegates expected to vote for him. There were, however, elements of weakness in his candidacy. He had echoed the sentiment of Lincoln's house-divided speech, terming the slavery dispute an «irrepressible conflict between opposing and enduring forces,» one of which must eventually triumph, but he had previously declared in a Senate debate that there is a higher law than the Constitution governing the nation's stewardship of the public domain. This had associated him in the public mind with the extreme abolitionists by whom the constitution was openly flouted. Some of the Northern States which Frémont had failed to carry were necessary to Republican success. Three of them, Pennsylvania, Indiana and Illinois, were to elect State officers in October. Republican leaders, in the last two especially, were convinced that Seward's nomination would alienate many voters otherwise friendly. Their firm opposition coupled with the purely personal hostility of Horace Greeley, whose newspaper, the *New York Tribune*, was widely read by Republicans, led to caution and delay. There was the usual array of «favorite sons» to receive perfunctory support on the opening ballot, but it was soon apparent that if Seward were set aside Lincoln would be the choice. The nomination was dictated by considerations of availability. Lincoln could carry Illinois — had done so but two years before. Indiana probably would favor him also. Pennsylvania, pledged to Simon Cameron, was indifferent toward Seward. In the midst of excitement prudence worked powerfully. Seward received but 173½ votes at first, 40½ fewer than the required majority. Lincoln had 102. The leader gained 11 votes on the second ballot as against a gain of 79 for his rival. The third resulted in a majority for Lincoln, and after a painful delay the nomination on motion of New York was made unanimous.

The Democratic convention had met at Charleston, S. C., in the preceding month (23 April 1860) hopelessly divided. Douglas held a decided preponderance over all opponents but not a two-thirds majority as required by the party usage. He had offended the South beyond forgiveness by his course in the debates with Lincoln hardly less than by his contumacy on the Kansas issue. The North refused to yield and the convention split into two angry factions without nomination by either. Eventually two Democratic candidates were presented, Douglas being named by the Northern wing and John C. Breckenridge of Kentucky by the Southern minority. A fourth ticket, headed by John Bell of Tennessee, appealed to the neutral element and proved stronger than was expected; it prevailed in three of the slave-holding States whose electoral votes aggregated 39. While division in the dominant party lent encouragement and vigor to the Republican campaign it can hardly be doubted that the pro-slavery element would have failed in any event. Lincoln received 180 electoral votes, all from the North, and Breckenridge 72, all from the South. Douglas carried Missouri only, but through a fusion agreement obtained three electoral votes from New Jersey, a total of 15. The popular vote, however, varied remarkably, that of Breckenridge being but a trifle more than that accorded to Bell. Douglas outstripped the former by more than half a million and fell behind Lincoln by a slightly lower number. The combined opposition polled nearly a million more votes than were cast for the candidate whose majority in the electoral college was 57 over all. Lincoln never forgot that he was a minority President, nor that his nomination had come from a convention «which was two-thirds for the other fellow.» To his analytical mind these circumstances evinced a confused state of public feeling and opinion calling for caution no less than firmness in the execution of his official trust.

The interval between the election and inauguration day (4 March 1861) was utilized by the southernmost States in perfecting measures of secession. Though it was well known that the incoming administration intended no interference with slavery where it already existed, its protagonists were stung to the quick by the decision of the country to confine the system to a limited area, and that upon the avowed ground that it was both politically and morally a wrong. Such a decision they regarded as insulting, but more than that, they perceived that it placed their cherished institution, as Lincoln had phrased it, «in the course of ultimate extinction.» Their resentment and their fears led to speedy action. Pretexts for dissolving the Union were not wanting; the thought was not new. Buchanan, confused and terrified by the situation, interposed no obstacles. In his message to the new Congress (3 Dec. 1860) he easily demonstrated the utter illegality of all attempts to secede, but with astonishing want of logic maintained that the Federal government possessed no lawful right to resist secession. In a word, that a nation ordained to be perpetual could not defend its perpetuity without breaking the law of its being. The result was that when the President-elect arose to repeat the inaugural oath, with its specific obligations to protect and defend the national Constitution and to take care that the laws be faithfully executed, the forms of secession were already accomplished and a new nation, «all slave,» was asserting its separate existence.

The inaugural address, as tactfully as the case would admit, but without the slightest hint of uncertainty, declared that in view of the Constitution and the laws the Union was unbroken; that all resolves and ordinances of attempted secession were legally void; and that so far as the means were provided the President would execute the laws in all the States alike. The rest was a calm review of the grounds of dissension and a moving appeal to the minds and hearts of all lovers of the Union for a peaceable settlement and a resumption of healing friendships. The address made no impression in the South except as its moderation was construed as a sign of weakness. The North indeed failed to grasp its real significance. As a declaration of policy it never stood in need of revision or enlargement. Doctrine, duty, purpose and method are all clearly defined; only the wisdom, perseverance, resourcefulness and will of the speaker were as yet unknown. With sagacity which seemed to border on rashness he summoned to his Cabinet the four principal leaders who had contested his nomination, Seward, Chase, Bates and Cameron. At least two of these deemed themselves vastly superior to their chief in all the qualities of statesmanship. Their great abilities served the country well, but the President's mastery was not long in doubt. Carefully avoiding acts of aggression, and with equal care declining to recognize by word or deed the claims of the so-called Confederate government, he waited for the crystallization of Union sentiment. It came with the assault upon Fort Sumter and its enforced surrender, 14 April 1861. The following day he proclaimed a state of insurrection, called forth the militia to the number of 75,000 and summoned Congress to assemble on the ensuing 4th of July. Four days later a blockade of some of the Southern ports was announced. Other measures of defense were taken, including calls for volunteers to re-enforce the regular army and navy, suspension of the writ of habeas corpus in disaffected quarters, extension of the blockade, and the like, all in harmony with the declared purpose to protect the Union and execute its laws.

Pending the meeting of Congress loyal sentiment gradually strengthened. In a message of great power the case for the government was explained and enforced. All suggested legislation was promptly enacted. The South, more firmly united and not less determined, plunged into a military struggle and four years of bloody warfare ensued. The story of battles and campaigns must here be omitted; neither can the civil history of that troubled period be narrated except in barest outline. There were many in the loyal States whose resentment of Southern domination led them to favor separation as a fortunate riddance. Others accepted the extreme view of State rights, including the right of secession. Many shrank from civil war and would consent to disunion rather than fight. The abolitionists would make the war a means of destroying slavery forthwith, while the President and a vast majority of his party were committed to the doctrine that abolition could not lawfully be enforced. These must unite, if at all, upon the single purpose of saving the Union. The avowal of any other aim within the first year inevitably would have wrecked the national cause. Lincoln almost alone perceived that the one unifying appeal must be kept in the foreground, and with undying patience, disregarding ridicule, distrust and obloquy, he restrained rashness, encouraged the timid, reassured the doubtful, persuaded the hostile. At bottom his title to enduring fame rests upon his unerring comprehension of the great task before him and his matchless skill in putting into timely and convincing words the fundamental truths to which the minds of honest men at last must yield. Slavery which had invoked the sword perished by the sword. Emancipation came (1 Jan. 1863) not of set purpose but as a by-product of national self-preservation. Neither side expected it. «Each,» as stated in the second inaugural, «looked for . . . a result less fundamental and astounding.» But Lincoln's credit for the event is no less because he waited for an occasion to strike lawfully and with assured effect. It must have given him intense satisfaction. «I am naturally anti-slavery,» he wrote to A. C. Hodges, 4 April 1864. «If slavery is not wrong nothing is wrong. I cannot remember when I did not so think and feel. Yet I have never understood that the presidency conferred upon me an unrestricted right to act officially upon this judgment and feeling.» Emancipation, when it came, was purely a military expedient, a blow at the economic resources of a public enemy. «I felt,» he stated in the same letter, «that measures otherwise unconstitutional might become lawful by becoming indispensable to the preservation of the Constitution through the preservation of the nation. Right or wrong I assumed that ground and now avow it. I could not feel that, to the best of my ability, I had even tried to preserve the Constitution if, to save slavery or any minor matter, I should permit the wreck of the government, country and Constitution all together.» He had prepared well for the finishing stroke by proposing and urging a settlement on the basis of compensated emancipation. Logically, enemy property, especially that which the owner refused to sell, might be seized for military purposes. But only such as could be captured fell within that rule, hence a doubt as to the legal effect of a mere announcement of freedom to slaves not within military reach. This doubt was practically solved by the President's emphatic declaration that he would never retract or modify the edict of emancipation nor return to slavery any person freed by its terms. This was repeated in his last annual message (6 Dec. 1864), this final assurance being added: «If the people should, by whatever mode or means, make it an executive duty to re-enslave such persons another and not I must be their instrument to perform it.» Negro regiments helped to extend the military lines which ultimately carried the reality no less than the promise of freedom to every slave. The 13th amendment to the Constitution was but the formal recognition of a fact already accomplished.

A marked example of both the sagacity and the magnanimity of the President is found in his selection of Edwin M. Stanton as Secretary of War upon the early retirement of Cameron. This imperious but intensely loyal man had treated Lincoln with marked discourtesy both before and after the latter came to the Presidency. But Lincoln comprehended both the strength and the weakness of his waspish critic. Disregarding the personal affronts he placed Stanton in a position of almost despotic power, and reaped for himself and the country a harvest of incomparable service. In the same spirit he made Salmon P. Chase chief justice of the United States Supreme Court, after that great minister of finance had retired from his Cabinet a disappointed aspirant for the presidential succession. General McClellan, while in command of the Potomac army, displayed toward his great superior a very unfortunate attitude. Remonstrances against submission to such treatment called forth no response but this: «I would hold McClellan's horse if that would bring us victories.» Chief among his many disappointments was the failure, one after another, of his chief military appointees. The field of choice was limited, of course, to those educated for the army and not openly disloyal. Only experience could determine who of these were fit to command. He would not condemn any in haste. Some were retained perhaps too long because better were as yet unknown. Repeated disasters at last sent incompetents to the rear and possibilities of victory began to emerge. High hopes inspired by the fall of Vicksburg (4 July 1863) and the concurrent defeat of Lee at Gettysburg suffered painful relapses. The following spring (9 March 1864) General Grant, whose successful career in the West had won the country's confidence, was placed in supreme control. Thence onward unity of plan and movement took the place of divided efforts. Meanwhile, very largely under the President's personal direction, the dangers of foreign intervention were met and averted. But as the season for nominations and elections approached conditions were extremely depressing. Immense losses attended the grapple with Lee's army in the Wilderness of Virginia. In Georgia the forces under Johnston were eluding the efforts of General Sherman to bring them to bay. Financial difficulties accumulated; discontent spread among powerful leaders in Congress and elsewhere. Lincoln naturally desired re-election, both on his own account and for the national cause, but the clamor of the few and the slow progress of events in the field led him at times to forbode defeat both in convention and at the polls. The convention met at Baltimore, 7 June 1864. His renomination, never in doubt, was made unanimous upon the first ballot. For reasons of expediency, a Vice-President was named from the South, Andrew Johnson of Tennessee succeeding Hannibal Hamlin of Maine. Opposition on the part of radicals did not cease immediately. They had previously (31 May 1864) held a mass convention which assumed to name Frémont as a Republican candidate, but no manifestation of popular support was evoked and its ticket was later withdrawn. The Democratic convention (29 Aug. 1864) nominated Gen. George B. McClellan, who despite his repeated failures as a general had retained a singular hold upon popular favor. His failures indeed had enhanced his popularity, owing to strenuous claims that the administration had thwarted his military plans in order to disgrace him. No more dangerous candidate could have been chosen as matters then stood, but the convention platform was a marvel of political unwisdom. It recited as an historical fact that the war so long waged for the Union had been a «failure,» and demanded the immediate cessation of hostilities that peace might be obtained through a convention of the States. Opportune victories, however, put an end to the charges of failure. The capture of Atlanta (2 Sept. 1864) and Sheridan's whirlwind progress through the Shenandoah Valley were campaign arguments of compelling force. McClellan carried but three States, New Jersey, Delaware and Kentucky, casting 21 electoral votes. Lincoln received all the rest, 212 in number, and a popular majority of nearly 500,000.

Opposition in the North practically ceased with this overwhelming vote of confidence. There were murmurs of discontent over the President's evident inclination to deal leniently with the misguided South, but these came from would-be leaders rather than the masses. The Confederacy speedily fell apart. By his patience and sagacity, by his steadfast resolve and his faith in the integrity and capacity of the people, by his ready sympathy with the common sufferings and his eagerness to receive and to grant petitions for help and for mercy he had acquired and at last enjoyed an influence far greater than the mere authority of his office. Constantly assailed by ignorance and malice he had so administered his great trust as to make reunion comparatively easy. Hardly a word of denunciation fell from his lips or pen throughout those trying years. «I shall do nothing in malice,» he wrote. «What I deal with is too vast for malicious dealing.» His almost unbounded charity was based upon a profound study of the feelings and motives of men. He ruled by a right more Divine than any right of kings.

The principal army of the Confederacy surrendered to General Grant 9 April 1865. It was confidently expected that further resistance would shortly cease. In the elation of the moment it was resolved to celebrate the fourth anniversary of the fall of Fort Sumter by a harmless bit of ceremony, signalizing upon the same spot the restoration of the national authority throughout the land. Accordingly at noon of that day the identical flag which Major Anderson had been forced to haul down as the first definite concession to armed insurgency was by the same hand again unfurled above the crumbling fortress. That evening, the mission of the great President being in substance performed, his martyrdom was also accomplished. He had sought relaxation by witnessing a play at Ford's Theatre in Washington. There he was shot by a crazed secession zealot, J. Wilkes Booth by name, stealthily approaching from the rear. He fell unconscious in the arms of his wife and died at about seven of the following morning. The tragedy proved but a part of an infamous plot to slay several leading officials of the government. Secretary Seward, at about the same hour, was dangerously stabbed by one of the conspirators while lying sick at his home. Other intended victims escaped through miscarriages in the concerted scheme. Booth, leaping from the President's box to the stage below, sustained a fracture of the leg, but with the aid of confederates escaped across the Potomac. He was soon discovered in hiding and was fatally shot while resisting arrest. Four of the remaining conspirators, including a widow named Mary Surratt, were convicted by a military court and hanged (7 July 1865). Four others were sentenced to prison. Naturally the Confederate government was suspected of direct complicity in the crime. The suspicion was unfounded, but the mingled grief and rage of the people brought upon the South distressing consequences. Harsh measures of reconstruction were adopted, such as Lincoln surely would have disapproved and by his great influence might have averted. Friend and foe suffered in a common calamity.

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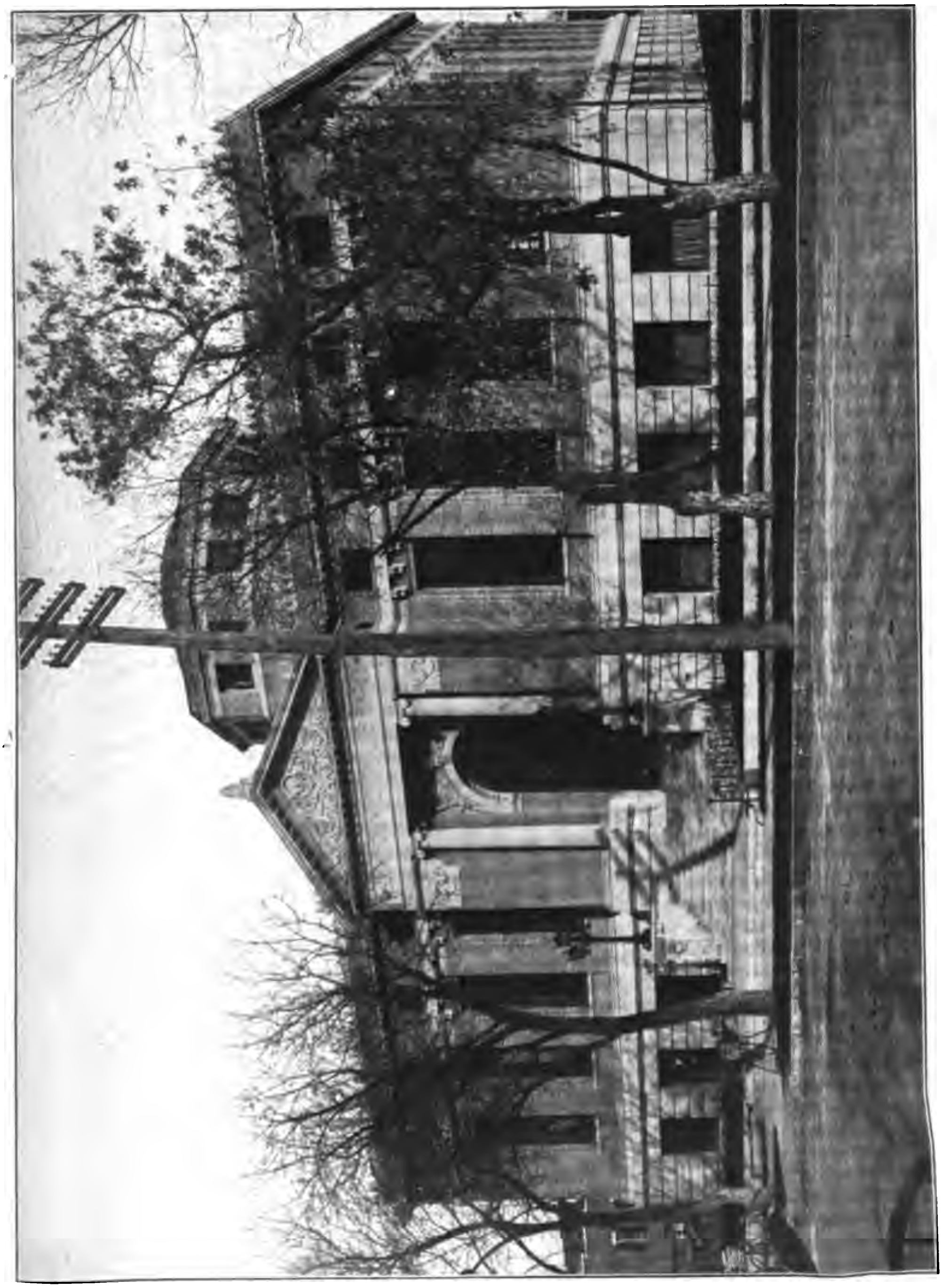
DANIEL FISH,
Judge, District Court, Minneapolis; Author of Lincoln Bibliography, etc.

LINCOLN, Benjamin, American general: b. Hingham, Mass., 24 Jan. 1733; d. there, 9 May 1810. Until the age of 40 he followed the calling of a farmer, holding also at different times the offices of magistrate, representative in the provincial legislature and colonel of militia. He was also an active member of the three provincial congresses of Massachusetts, and as militia officer displayed an efficiency which procured his promotion in 1776 to the rank of major-general. In this capacity he became favorably known to Washington during the siege of Boston. In the beginning of 1777 he joined Washington at Morristown with a new levy of militia, and soon after, at the suggestion of the commander-in-chief, was transferred to the continental service with the rank of major-general. He was sent to join the forces assembled to oppose the progress of Burgoyne, and during the battle of Bemis' Heights commanded inside the American works; and was severely wounded in the leg and compelled for nearly a year to retire from service. In September 1778 he was appointed to the command of the southern army, and upon the arrival of Count d'Estaing co-operated with the French troops and fleet in the unsuccessful assault on Savannah. From the unwillingness of his allies to continue the siege he was obliged to return to Charleston, where in the spring of 1780 he was besieged by a superior British force under Sir Henry Clinton. After an obstinate defense he was forced in May to capitulate, and retired to Massachusetts on parole. In the spring of the succeeding year he was exchanged, and subsequently participated with credit in the siege of Yorktown. In consideration of his merits and misfortunes Washington appointed him to receive the sword of Cornwallis upon the surrender of the British forces. He held the office of Secretary of War 1781–83, and in 1787 commanded the forces which quelled the Shays' Rebellion in western Massachusetts, and in the same year was elected lieutenant-governor of the State, which office he held one year. He was collector of Boston 1789 till about two years before his death. He was a member of the commission which in 1789 formed a treaty with the Creek Indians, and of that which in 1793 unsuccessfully attempted to enter into negotiations with the Indians north of the Ohio. In his later years he took great interest in science and wrote several papers many of which attracted attention at the time. Lincoln's earnest character and his unselfish public spirit were greatly admired and he was deservedly popular toward the close of his life. Consult life by Bowen in Jared Sparks' ‘American Biography’ (2d series, Vol. XIII, Boston 1847).

LINCOLN, Charles Perez, American lawyer: b. Quincy, Mich., 7 Oct. 1843. He was educated at Hillsdale College; entered the Union army at the beginning of the Civil War and served until mustered out of the service in June 1864. He was admitted to the bar in 1871; was consul at Canton, China, 1875–81, and then began to practise his profession in Washington. He was elected commander of the Department of the Potomac, G. A. R., in 1888, and was 2d deputy commissioner of pensions 1889–93.

LINCOLN, David Francis, American hygienist: b. Boston, Mass., 4 Jan. 1841. He was graduated at Harvard University in 1864 and at its medical school in the same year, and served as acting assistant surgeon in the United States navy during part of the Civil War (1864–65). He practised as specialist in nervous diseases, lectured and did literary work in connection with Hobart College, Geneva, N. Y., for some years, beginning in 1881, having previously relinquished medical practice. He has published ‘Electro-Therapeutics’ (1874); ‘School and In-

LINCOLN, NEB.



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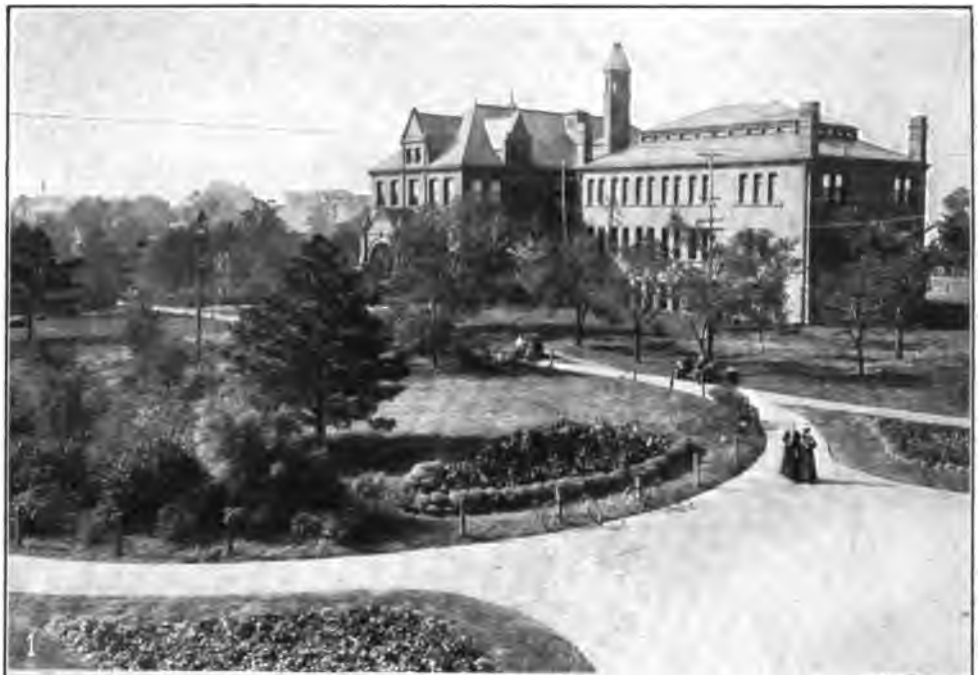

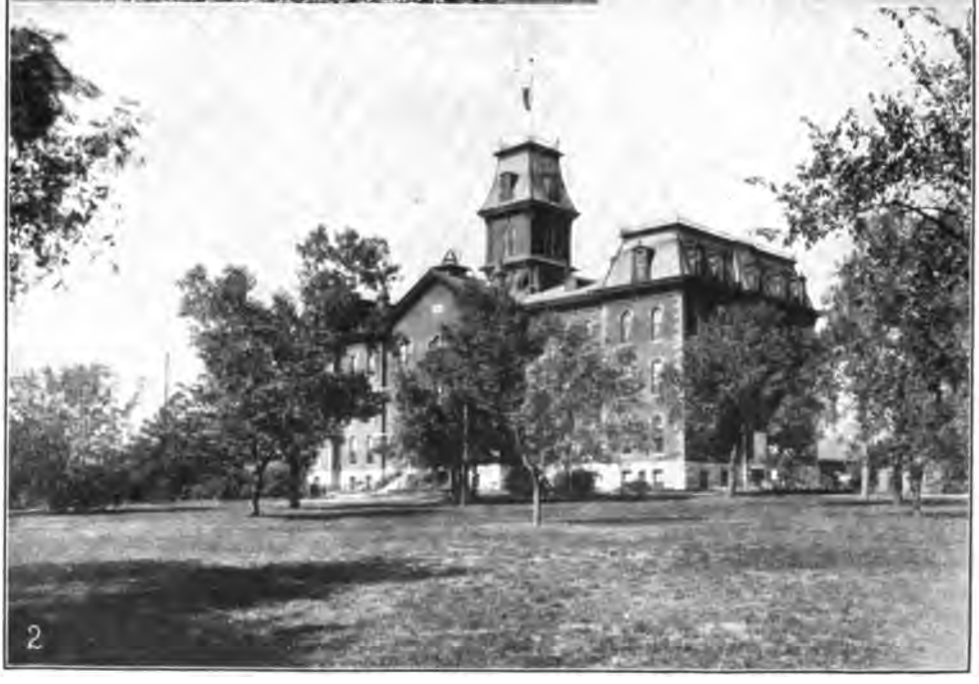

1 Main Building, University of Nebraska

2 Library, University of Nebraska

dustrial Hygiene' (1880); 'Hygienic Physiology,' a school textbook (1893); 'Sanity of Mind' (1900), and a work on the education of the feeble-minded.

LINCOLN, Mary Johnson Bailey, American household economist: b. South Attleboro, Mass., 8 July 1844. She was educated at Wheaton Seminary, Norton, Mass., in 1864, was married to David A. Lincoln (now dead) in 1865, and since 1879 has been prominent as a lecturer and writer on household matters. She was the first principal of the Boston Cooking School, and edited the *American Kitchen Magazine* from 1893 to 1903. She has lectured on cookery in seminaries and in most of the large cities of the country. She has published 'The Boston Cook Book' (1884); 'Peerless Cook Book' (1886); 'Carving and Serving' (1886); 'The Boston School Kitchen Text Book' (1888); 'What to Have for Luncheon' (1904); 'School Kitchen Text Book' (1915).

LINCOLN, Robert Todd, American lawyer: b. Springfield, Ill., 1 Aug. 1843. He is the eldest son of Abraham Lincoln, and was graduated at Harvard College in 1864. He entered the Harvard Law School, but left it for the army and served on the staff of General Grant as captain. On the close of the war he resumed his legal studies and was admitted to the Chicago bar in 1867. He was Secretary of War, 1881–85, and although mentioned as a candidate for the Presidency in the last-named year declined to allow his name to be placed in opposition to that of President Arthur. He was Minister to Great Britain in 1889–93, and became counsel of the Pullman Company in 1893; in 1897 he became president and in 1911 chairman of the board of directors of the Pullman Company.

LINCOLN, England, an episcopal city, civic county and parliamentary and municipal borough, the capital of Lincolnshire, on the Witham, at the junction of several railroads, 130 miles north of London. It dates from pre-Norman times, was the Roman "Lindum Colona," and at the time of the Norman Conquest a fortified town of considerable importance. The principal edifice is the cathedral, chiefly of early English but with interesting transitional phases, crowning a height, on the summit and slope of which the town is built, 210 feet above the river. Its conspicuous site makes it a familiar landmark for miles around. It is surmounted by three towers, two 180 feet high, and the central tower is 271 feet high. The latter is one of the glories of English ecclesiastical architecture and dates from 1235 to 1317. The celebrated Angel Choir was completed in 1280. The total interior length of the building is 482 feet, the nave is 252 feet long, and width, including the aisles, 82 feet. The bell (Great Tom of Lincoln) weighs five tons eight hundredweight. Other prominent buildings are the Saint Mary's Guildhall (12th century); the Jews' House, one of the finest specimens of Norman domestic architecture in England; the remains of the castle begun in 1086 by William the Conqueror; the ancient episcopal palace, and the fine old Roman gateway, the Newport Arch, of date 104 A.D., which spans Hermin street. There is a theological college and a school of art. An extensive trade in corn, flour and wool is carried on, and there are important manufactures of machinery and agricultural implements. The municipality possesses valuable estates in Buckinghamshire and Lincolnshire and much valuable property in the city. The public utilities are municipally owned. A new water supply was introduced from Elkesley, Nottinghamshire, in 1911. The city returns one member to the House of Commons. Pop. of county borough 57,285. Consult Allen, 'History of Lincoln' (London 1833), and Kendrick, A. F., 'The Cathedral Church of Lincoln' (in Bell's Cathedral Series, London 1898).

LINCOLN, Ill., city, county-seat of Logan County, on the Illinois Central and the Chicago and Alton railroads, about 28 miles northeast of Springfield and 135 miles southwest of Chicago. The place was settled in 1835 and incorporated in 1854. It is situated in an agricultural region and extensive deposits of coal are in the vicinity. The chief manufactures are cellulose, horse-collars, corn-cutting machinery, signal horns, flour, mattresses, caskets and coffins, excelsior. The farm and dairy products and the coal mines contribute to the wealth of the city. Lincoln is the seat of the State Institution for Feeble-Minded Children, and of the Lincoln University, opened in 1865 under the auspices of the Cumberland Presbyterians. It has a free public library, the building a gift from Andrew Carnegie; a Deaconess Home and Hospital, Saint Clara's Hospital and Odd Fellows' Orphans' Home. Abraham Lincoln practised as a lawyer in the old courthouse here. The city was named in his honor and he assisted in laying it out. Lincoln adopted the commission form of government in 1915. Pop. 11,532.

LINCOLN, Kan., city and county-seat of Lincoln County, on the Saline River, and on the Union Pacific Railroad, about 155 miles west of Topeka and 105 miles west of Wichita. It is in an agricultural region in which are raised large quantities of wheat and corn and a number of cattle. Limestone quarries in the vicinity contribute to the industrial wealth of the city. The industries and trade are connected chiefly with farm and dairy products and with live stock. The waterworks and lighting plant are municipally owned. Pop. 1,508.

LINCOLN, Neb., city, capital of the State and county-seat of Lancaster County, on the Chicago, Burlington and Quincy, the Chicago, Rock Island and Pacific, the Union Pacific, the Missouri Pacific, the Chicago and Northwestern and other railroads, about 55 miles west of the Missouri River, and about the same distance north of the Kansas State line. The city, located in the midst of a fertile agricultural district, in the Salt Creek basin, at an elevation of 1,045 feet, rises gradually to the south and east, leaving the creek to the west and north. The location of the capital at this point was due in part to the numerous radiating branches of Salt Creek, but more especially to the saline springs which in early days furnished salt to the Indians and the buffalo, and later to the overland emigrants and the early settlers of Nebraska. The site selected by a commission, 14 Aug. 1867, was surveyed the same fall, and from the proceeds of lots sold at auction the first capitol, the insane asylum and the original university building were erected and completed by 1871.

Lincoln bids fair to fulfil the prediction of its founders by becoming a great railroad centre, as it already has 12 radiating lines, owned by five of the great corporations that now dominate in the West as already mentioned. With one exception each railroad has its own station and yard. The Chicago, Burlington and Quincy repair and construction shops, employing 500 skilled mechanics, are located at Havelock, a suburb of Lincoln. About 50 passenger trains enter, and the same number leave, Lincoln every 24 hours. Lincoln's railroad connections make it the great convention centre of the State. The names of Lincoln and Douglas are strangely associated in Nebraska history. The site selected for the capital in 1867 and named Lincoln is practically identical with the one proposed 10 years earlier to have been called Douglas. Thus the author of the law organizing the Territory of Nebraska failed to have his name perpetuated in its capital, but yielded that honor to his great rival. Lincoln is laid out, like most Western cities, on the checker-board plan, with streets 100 or 120 feet in width. These broad streets are in general lined with trees and flanked with large lawns. The city contains an unusually large number of comfortable homes, excelling in this respect its development in business blocks. Over 20 miles of the streets are paved with brick, asphalt or cedar blocks. The waterworks are owned by the city; 50 miles of mains distribute the water from two deep wells, from which about 1,500,000 gallons of the very purest water are pumped per day. There are over 40 miles of sanitary and 6 miles of storm-water sewers in the city.

Manufacturing is of course yet in its infancy, but the total output per year approximates $5,000,000. A few industries are, however, well established. The making of leather goods, such as horse-collars, harness, etc., is not equaled west of the Missouri River. The production of oils and paints, mattresses and bed-springs, overalls and shirts is large and developing rapidly. A large butter and creamery station is located at Lincoln. It receives cream from some 200 substations. The jobbing and wholesaling industry is well under way, and in a few lines has reached creditable proportions. Lincoln, with 22 branch houses, is the largest distributing centre for farm machinery in the West. The jobbers in butter and eggs, fruits and groceries are doing a good business. There is also a fair beginning in hats, hardware, drugs, furniture, coffins, paper, sash and doors, iron for plumbing, jewelry, crockery and queensware, lumber and coal. Two fair-sized grain elevators have recently been constructed. Total estimated business of jobbers and wholesalers annually about $18,000,000. Lincoln is also becoming quite a centre for insurance business. Two strong life insurance companies, two fire insurance, three fraternal companies, including the Modern Woodmen with headquarters here, and several mutual companies indicate the scope of development. The banking capital is small for a city of its size: five commercial banks, capital $500,000, surplus $180,000, and deposits $5,115,000, and one savings bank, deposits $140,000, supply the business community. The State fair grounds, the penitentiary, one of the insane asylums and the Home of the Friendless are located in or near the city. The other public buildings are the capitol, costing $750,000; the county courthouse, $200,000; city hall, $150,000; Federal building, $350,000; Carnegie library, $75,000 and the grounds; 19 public school houses that cost from $15,000 to $50,000 each; Saint Elizabeth's Hospital, $150,000; the Catholic Orphans' Home and the Tabitha Home — private institutions — aid in caring for the sick and unfortunate. The mineral waters are used in several private sanitariums.

For outdoor amusement there are one small public park; the university athletic field, the Epworth Assembly park and the "Country Club" grounds afford meagre facilities. The city supports one theatre and an auditorium.

The commission form of government was adopted in 1913, and provides for a mayor and council of five members, elected for two years.

Lincoln is at present rather an educational than a business centre. Its population is largely American, representative of the North and Middle West. Neither great wealth nor extreme poverty is found. The public schools are efficient and enroll 6,210 students. The high school employs 36 teachers and registers 1,090 pupils, a number claimed to be unsurpassed by any city of its size. There are three musical conservatories, three universities, three colleges, one preparatory school and two parochial high schools, which tend to give a distinct educational tone to the public as well as private life of the city. The largest and most important educational institution is that of the State University and Agricultural College (q.v.). The Wesleyan University (q.v.), situated in University Place, a suburb of Lincoln, ranks next in importance. Union College (q.v.), a Seventh Day Adventist school, with three buildings and over 400 students, and Cotner University (q.v.), controlled by the Christian Church, with one good building and 200 students, are prospering. The conservatories and other schools add several hundred more students to this list. The public libraries are the University, 60,000 volumes; the State, 40,000; the City, 15,000, and the High School, 2,500. Lincoln's educational output is indicated in the second-class mail matter sent through its post office. One per cent of all the second-class mail matter of the United States originates in Lincoln. In all 66 publications are entered, one with 750,000 circulation, two others with about 150,000 each, and a fourth with over 100,000. There are 30 church buildings in Lincoln. The following organizations are represented: Methodists, Congregational, Presbyterian, Christian, Baptists, Lutheran, Episcopal, Catholic, United Presbyterian, Jews, Christian Science, Unitarian, Reformed, Swedish, Free-will Baptists and several minor denominations. There are three colored churches. The leading denominations all have exceptionally fine buildings. Lincoln's growth has been somewhat irregular, yet counting decades gradual, Lincoln in 1867 — then called Lancaster — contained only one store and some half-dozen dwellings. By 1870 it contained 2,441 people. In 1880, 13,004. The padded census of 1890 gave the city 55,154 population — a number too large by at least 20,000. Pop. 45,643. Consult Cox and Hayes, 'History of the City of Lincoln' (Lincoln 1889).

LINCOLN MEMORIAL, WASHINGTON, D. C.

LINCOLN COLLEGE, established at Lincoln, Ill., in 1866, under the auspices of the Cumberland Presbyterians, since 1906 is affiliated to the Presbyterian Church U. S. A., when the chief section of the Cumberland Presbyterians united with the parent body. It has a preparatory department, and the college courses lead to the degrees of A.B., B.S. and B.L. In 1917 there were connected with the college 20 professors and instructors and 254 students. The library had about 7,000 volumes; the grounds, buildings and apparatus were valued at nearly $80,000; the productive funds were $120,000, and the income from productive funds, tuition and other fees amounted to about $20,000.

LINCOLN COLLEGE, Oxford, England, a foundation of Oxford University (q.v.) dating from 1427. It consists of a rector, 12 Fellows and 14 scholars. The founder was Richard Flemyng, bishop of Lincoln, at first a supporter but later a strong opponent of Wyclif's doctrines. The foundation was strengthened and firmly established in 1478 by Thomas Rotherham, a subsequent bishop of Lincoln. John Wesley, Fellow from 1726–57, was one of the distinguished associates of this college. A modern library building of Jacobean architecture, opened in 1906, has been added to the buildings, the earliest of which, the hall, dates from 1436.

LINCOLN HIGHWAY, a continuous connecting improved road, the backbone of a national highway system, crossing the continent through the heart of the most densely populated regions between New York and San Francisco. The highway was laid out by the Lincoln Highway Association, a Michigan corporation with headquarters at Detroit, in 1913, as the first inter-State highway connecting the two coasts and as a memorial to Abraham Lincoln. The route was determined upon entirely from the national standpoint and with no local interests in view. It is the shortest and most direct road consistent with the topography of the country between the two coasts; due to the efforts of the Lincoln Highway Association and the co-operation of the various States and counties traversed, the original distance of 3,389 miles having been cut to 3,324 miles, by the elimination of unnecessary detours and by numerous instances of shortening and straightening. A total of over $15,000,000 was expended upon Lincoln Highway improvement and maintenance from the laying out and dedication of the road until 1 Jan. 1919. Plans for 1919 construction indicated the expenditure of about $10,000,000 on the highway. With the co-operation of the State Highway department of Utah, the Great American Desert between Salt Lake City and Ely, Nev., was bridged and 50 miles cut from the transcontinental route. This important keystone section of the highway was completed in July 1919.

The Lincoln Highway starts at Times Square, 42d street and Broadway, New York city and passes through the following principal cities in 11 States: Jersey City, Newark and Trenton, N. J.; Philadelphia, Lancaster, York, Gettysburg, Chambersburg, Bedford, Ligonier, Pittsburgh and Beaver, Pa.; East Liverpool, Canton, Ashland, Mansfield, Bucyrus and Lima, Ohio; Fort Wayne, Ligonier, Goshen, Elkhart, South Bend and Valparaiso, Ind.; Chicago Heights, Aurora, Geneva, Rochelle, Dixon and Fulton, Ill.; Clinton, Cedar Rapids, Marshalltown, Jefferson and Council Bluffs, Iowa; Omaha, Columbus, Grand Island, Kearney, North Platte and Big Springs, Neb.; Cheyenne, Laramie, Medicine Bow, Rawlins, Rock Springs and Evanston, Wyo.; Salt Lake City, Garfield, Tooele, Clover and Ibapah, Utah; Ely, Eureka, Austin, Fallon, Reno and Carson City, Nev.; Truckee, Placerville, Sacramento, Stockton, Oakland and San Francisco, Cal. The terminus is at Lincoln Park overlooking the Golden Gate. The Lincoln highway is free to traffic of all descriptions between the two coasts. The route is marked with a distinctive red, white and blue marker, bearing a blue «L» on the central white field. The Lincoln Highway Association has been largely financed through yearly contributions made by «Founders» of the organization, men and companies interested in highway improvement. For every mile of improvement secured on the Lincoln highway, 10 miles have followed as a direct result upon other routes connecting important centres north and south with the main line. Along its entire length the highest type of highway construction is represented in this modern American Appian Way.

LINCOLN MEMORIAL, Washington, D. C., erected in Potomac Park on the axis of the United States capitol and the Washington monument, was commenced on Lincoln's Birthday 12 Feb. 1914. The foundation was completed and the cornerstone laid 12 Feb. 1915. This beautiful memorial was erected in accordance with an act of Congress approved 9 Feb. 1911, a subsequent act of Congress 28 Feb. 1916, limiting the cost to $2,594,000 to include the approaches. The building is constructed of Colorado Yule marble, Indiana limestone and Massachusetts pink granite, and is 201 feet 10 inches long by 132 feet wide at the bottom step of the stylobate course, 79 feet 10 inches high from the top of the foundations to the top of the attic. The building is in the general form of the classic Greek temple, consisting of one large enclosed hall, oblong in shape and surrounded by a colonnade of doric columns, representing the States of the American Union. The longer axis of the building extends north and south. The entrance is a wide doorway on the eastern side, facing the Washington monument and the capitol building, which are in direct line with this memorial. On the inside of the building opposite the entrance is a seated statue of Lincoln, cut in heroic proportions from white Georgia marble by Daniel Chester French. To the right and left of the statue are four large columns on each side, forming two rows which partly cut off the ends of the hall. On the north wall of the interior is a tablet containing Lincoln's second inaugural address, while a similar tablet on the south walls bears the Gettysburg speech. Over each of these memorials is a large allegorical painting by Jules Guerin, portraying the principles which it embodies. The memorial was constructed from plans by Mr. Henry Bacon, architect, under the direction of the Lincoln Memorial Commission, which was created by the act above referred to and under the supervision of the Secretary of War.

LINCOLN MEMORIAL UNIVERSITY, a coeducational institution, at Cumberland Gap, in Claiborne County, Tenn., chartered in 1897, largely through the efforts of Gen. O. O. Howard, of Burlington, Vt., who desired to see a school established in some place easy of access for the mountaineers of this locality, because of the great interest which Abraham Lincoln had in the people of this section. The institution comprises: Department of letters, department of science, school of music, school of nursing, school of agriculture, school of industrial arts, school of domestic science, school of business. Much emphasis is laid on agricultural and industrial work. The agricultural department conducts a large and thoroughly modern creamery which has a capacity of some 400 gallons of milk per day and can produce 1,200 to 1,400 pounds of butter per week. In the industrial department, carpentry, typesetting and other trades are taught to the boys and young men and domestic science is taught to the young women. By working for the school in the agricultural and industrial departments the students can earn at least a part of the cost of their education. The university owns 675 acres of land, besides controlling 3,000 acres of forest land. The endowment fund, in addition to the productive property, is a little in excess of $100,000. It has a number of buildings, including a library building, recitation halls, dormitories, creamery, barns, shop, etc. Exclusive of the summer school, it has an organization of about 20 teachers and 15 other workers. School is carried on for 48 weeks per year. About 700 students in the year enter the various departments of the institution.

LINCRUSTA-WALTON. See Linoleum.

LIND, Jenny (Madame Goldschmidt), Swedish singer: b. Stockholm, 6 Oct. 1820; d. Malvern, England, 2 Nov. 1887. In very early childhood she displayed the faculty for tune and of musical memory in such degree as to attract observation and at nine her voice was considered so remarkable that she was admitted to the Stockholm Conservatory of Music as a pupil of Crœlius and Berg. After years of thorough study and voice-building, in 1838 she made her début, with great success, as Agathe in 'Der Freischütz.' As operatic star in Stockholm and other cities in Sweden and Norway, she extended her fame, and in 1841 studied for the greater part of the year in Paris under Manual Garcia. She went to Berlin in 1844, studied German, and in Meyerbeer's 'Feldlager in Schlesien' appeared as Vielka. During the next year she made a Continental tour which established her in a position of supremacy, her great successes being won in Dresden, Leipzig, etc., and finally in Vienna. In 1847 she made her first appearance in England, which was followed by a succession of unprecedented triumphs. Her tour of the United States (1850–52) brought her not only fresh honors, but also large financial returns, and was long remembered by many who shared in the material and spiritual benefits which her noble womanhood and artistic genius conferred. In 1852 she was married in Boston to Otto Goldschmidt (q.v.), then conducting the Bach choir, and virtually retired from her profession, though subsequently reappearing on special occasions. She returned to Europe; at length settled in London; and made her last public appearance at Düsseldorf in 1870. In 1894 a bust of her was unveiled in Westminster Abbey. Consult Rockstro and Holland, 'Jenny Lind the Artist' (1891); Rockstro and Goldschmidt, 'Jenny Lind, Her Vocal Art and Culture' (1894).

LINDEN, or **BASSWOOD,** a genus of trees (*Tilia*) of the family *Tiliaceæ*, ordinarily known as basswoods in the United States. The species, of which there are about a dozen, are natives of the northern temperate zone and more or less resemble each other in general appearance. They are characterized by alternate, usually heart-shaped, leaves with toothed edges; small yellowish, often fragrant, flowers in cymes, the peduncles of which are attached to membranous bracts; and globular nut-like fruits about the size of peas. The trees, in many horticultural varieties, are widely planted in Europe, where they are known to the English as limes, and in America, for their pleasing form and dense shade, and to some extent also because of their abundant yield of nectar, from which bees make one of the finest qualities of honey. They are also planted for their timber, usually called «whitewood,» which is highly valued on account of its whiteness, lightness, toughness and durability, and is used for turned and carved ornaments and for making honey-boxes and other light articles, the whiteness of which is desired to enhance the appearance of the goods they contain; also extensively used for carriage bodies, cabinet-work and interior parts of furniture. The wood makes a high grade of charcoal, used by druggists, gunpowder-makers and artists. The fibrous inner bark is made into mats and cordage and strips of it are widely used for tying plants, etc. When stock-food is scarce in early spring the twigs and budding shoots are often fed to farm animals, being very mucilaginous and nutritive, though liable, it is said, to injure the quality of butter made from the milk of cows fed upon them. The best-known species are the American basswood (*T. americana*), a stately tree often exceeding 75 feet in height and 10 feet in girth. Its range extends from New Brunswick to Minnesota and southward to the elevated lands of Georgia and Texas. In the more thickly settled parts of this region it is becoming scarce as a timber tree because of the great demand for its wood. In America it is the most frequently planted species. Owing to confusion in nomenclature, the name «European linden» is applied to at least three species, *T. platyphylla*, *T. vulgaris* and *T. ulmifolia*. The first is most widely planted in America. The last is very late in blossoming and should be more extensively cultivated in order to extend the season of honey production. Lindens all thrive best upon good land. They are easily propagated from seeds, layers and grafts and by «stooling,» the small trees being cut down close to the ground, the sprouts covered with soil and when rooted removed to nursery rows.

In some countries the fibrous inner bark of the linden is separated by soaking in water and manufactured into fishing-nets, mats, shoes and clothing; and the cordage made from it is said to be remarkably strong and elastic. (See Bast). The wood is sometimes cut into thin strips and used in the manufacture of chip hats, which resemble those made of straw.

LINDLEY, lĭnd'lĭ, **John,** English botanist and horticulturist: b. Catton, near Norwich (Norfolk), 5 Feb. 1799; d. Acton, 1 Nov. 1865. He became Belgian agent for a London seed merchant in 1815, later took up botanical studies, published in 1819 a translation of Richard's 'Analyse du Fruit' and was appointed assistant librarian to Sir Joseph Banks at London. Later, he was successively made assistant secretary to the Horticultural Society (1822–41), professor of botany in the University of London (1829–60) and lecturer in botany to the Apothecaries' Company (1836–53). In 1828 he was elected to the Royal Society, whose royal medal he received in 1857, and in 1853 became a corresponding member of the Institut de France. He was appointed editor of the *Botanical Register* in 1826, of the *Journal of the Horticultural Society* in 1846; and in 1841 was a founder of the *Gardeners' Chronicle,* whose chief editor he was until his death. He was an able lecturer, a constant opponent of the Linnæan as contrasted with the natural system of classification and the author of several valuable works such as 'The Theory and Practice of Horticulture' (1842) and 'The Vegetable Kingdom' (1846). He also wrote almost the entire descriptive portion of London's 'Encyclopædia of Plants' (1822–29). His lectures attracted large audiences and excited great popular interest in England in the cultivation of plants. He encouraged public exhibitions of fruits and flowers. His influence as an editor was also very great and his textbooks were long standard in his native country.

LINDSAY, or **LYNDSAY,** lĭnd'zā, Sir **David,** Scottish poet, usually described as «of the Mount» (an estate near Cupar in Fife): b. about 1490; d. 1555. He studied in the University of Saint Andrews and in 1509 became page of honor to James V, then an infant. In 1528 he produced his 'Dreme' and in the following year presented his 'Complaynt' to the king. In 1530 he was inaugurated Lyon king-at-arms and knighted, and in 1531 sent on a mission to Charles V. He published a drama entitled 'A Satyre of the Three Estaitis,' played at court in 1539. In 1536 appeared his 'Answer to the King's Flyting'; and the 'History and Testament of Squire Meldrum' (1538). His last work, 'The Monarchie,' was finished in 1553. For more than two centuries Lindsay was the most popular poet in Scotland. His satirical attacks on the clergy in some degree paved the way for the Reformation.

LINDSAY, Harry. See Hudson, H. L.

LINDSAY, Samuel McCune, American political economist and educator: b. Pittsburgh, Pa., 10 May 1869. He was graduated from the University of Pennsylvania in 1889 and took post-graduate courses there and in Berlin, Vienna, Paris and Rome. After his return to the United States he was appointed assistant professor of sociology at the University of Pennsylvania and was professor from 1904 to 1907, when he was appointed professor of social legislation at Columbia University; he has also been editor of the department of sociological notes in the 'Annals of the American Academy of Political and Social Science' (1895–1901) and associate editor of the 'Annals' and was president of the academy in 1901. In 1892 he was special agent of the United States Senate Finance Committee to report on wholesale prices in Europe; in 1899–1900 was expert of the Industrial Commission to report on railroad labor; and from 1902 to 1904 was commissioner of education to Porto Rico, being granted leave of absence from the University of Pennsylvania. He has written 'Railway Labor in the United States' (1902); 'Social Work at the Krupp Foundries'; 'The Study and Teaching of Sociology'; 'The Unit of Investigation in Sociology'; and other articles in the 'Annals of the Academy of Political and Social Science'; Report on Education in Porto Rico'; 'History of Establishment of Public School System in Porto Rico' (1905) and edited three annual reports on Child Labor, National Child Labor Committee, New York (1904–07); edited the 'American Social Progress Series' and contributed to various reviews and magazines.

LINDSAY, William, American lawyer: b. Rockbridge County, Va., 4 Sept. 1835; d. 15 Oct. 1909. He was educated in his native State; removed in 1854 to Clinton, Ky., where after teaching school and studying law, he was admitted to the bar in 1858. Throughout the Civil War he served in the Confederate army, rising to the rank of captain and acting as a staff officer and after the war returned to Clinton and resumed the practice of law. In 1867 he was elected State senator as a Democrat; in 1870 took his seat on the bench of the Supreme Court of Kentucky; and was chief justice of the State, 1876–78, declining a renomination and returning to the practice of law at Frankfort. In 1889 he again entered the State senate; in 1893 served as commissioner of the World's Columbian Exposition; in the same year was elected to the United States Senate for the unexpired term of John G. Carlisle, who had resigned to become Secretary of the Treasury; and in 1894 he was re-elected, but differed from his party on the money question, and toward the end of his term usually voted with the Republicans. After leaving the Senate he went to New York City and once more resumed the practice of law. In 1901 he was appointed by President McKinley a commissioner for the Louisiana Purchase Exposition at Saint Louis in 1904.

LINDSAY, Canada, the capital of Victoria County, Ontario, a town and port of entry on the navigable Scugog River, and on the Grand Trunk and Canadian Pacific railways, 69 miles northeast of Toronto. The town is well built, chiefly of brick, has a large trade in lumber and grain and is the seat of a United States consular agent. It has lumber and flour mills, foundries, tanneries, breweries and manufactories of carriages, agricultural implements, sash, doors and blinds, woolens, boots and shoes, woodenware, etc. Pop. 6,964.

LINDSBORG, lĭnz'bôrg, Kan., city in McPherson County, on the Smoky Hill River and on the Missouri Pacific and the Union Pacific railroads, about 115 miles southwest of Topeka and 64 miles north by west of Wichita. It is in an agricultural region and its trade is chiefly in livestock, grain, broom-corn, flour and dairy products and manufactures brooms, brick, flour and spark plugs. It has large brick and lumber yards and grain elevators. An important industrial establishment is the Bethany Book Concern, the Western publishing institution for Lutheran literature. There are a number of Swedish Lutherans in Lindsborg. It is the seat of Bethany College, opened in 1881 under the auspices of the Lutherans. Among its departments, that of music is well known for its annual concerts, when the students render the ‘Messiah.’ The water and electric plants are the property of the city. Pop. 1,939.

LINDSLEY, linz'lĭ, **John Berrien,** American educator: b. Princeton, N. J., 24 Oct. 1822; d. 7 Dec. 1897. He was graduated from the University of Nashville in 1839 and received his degree in medicine at the University of Pennsylvania in 1843. Studying theology, he was ordained to the Presbyterian ministry in 1846 and preached for several years. He became professor of chemistry in the University of Nashville in 1850 and was chancellor of the institution 1853–73. He was likewise professor of chemistry in the University of Tennessee, 1880–97, and of materia medica in the Tennessee College of Pharmacy, 1876–97. He published ‘Our Ruin: its Causes and Cure’ (1868); ‘The Military Annals of Tennessee’ (1886). He also edited for many years the *Nashville Journal of Medicine and Surgery* and was a frequent contributor to periodicals.

LINE, Mathematical. *In geometry,* a line may be defined (1) as the locus described by a moving point; (2) as a magnitude which, at each of its points, has extension in one direction only; (3) as the boundary which separates two contiguous parts of a surface; or (4) as the intersection of two surfaces, or of a surface with itself. Each of these definitions has its own merits, and geometers use one or another of them, according to convenience.

In physics, «lines» of various kinds are constantly referred to, the context usually indicating the sense in which the word is used. A «line of force,» in a field of electric or magnetic force, for example, is a line whose direction, at every point, coincides with the direction of the force at that point. In the mechanical theory of heat (see THERMODYNAMICS) the state of a homogeneous body, with respect to its temperature, to the pressure exerted upon it and to the volume occupied by a unit of its mass, is often represented by means of a diagram in which two of these qualities are taken as abscissa and ordinate, respectively. In such a diagram an «isothermal» line is a line along which the temperature of the body remains constant; an «adiabatic» (or «isentropic») line is one which is so drawn that if the body should pass through the succession of states that the line represents it would not at any moment either absorb or emit heat. An «isopiestic» (or «isobaric») line is a line along which the pressure to which the body is exposed remains constant. An «isometric» line is one along which the volume of the body remains constant.

In steam engineering the various parts of the diagram that is drawn by an indicator are designated as «lines,» although they are but the several parts of a single line. Thus the «admission line» is that part of the diagram which the indicator draws while steam is being admitted to the cylinder; the «expansion line» is that part drawn while the steam in the cylinder is expanding; the «exhaust line» is that part drawn while the cylinder is in free communication with the atmosphere (or with the condenser); and the «compression line» is that part which the indicator draws after the exhaust valve has closed, and before the admission valve from the boiler opens again. The «atmospheric line» upon such a diagram is the line that the indicator draws when disconnected from the engine, and in free communication with the atmosphere. See also COLOR; DRAWING; PERSPECTIVE.

LINE ENGRAVING. See ENGRAVING and PHOTO-ENGRAVING.

LINEN, a cloth of very extensive use, made of flax, and differing from cloths made of hemp only in fineness. Hemp is in part now used in manufacturing cloths which are called linen. The flax from which linen is made is put through a number of processes previous to manufacture; *rippling,* the separation of the seed from the plant by means of beaters; *retting,* the elimination of resinous matter in the plant by steeping the stems in water and allowing fermentation to take place; *grassing,* in order to dry the flax stems; *scutching,* the removal of the woody portions of the stem from the fibrous; and *heckling,* the separation of the best of the flax. In common linen the warp and woof cross each other at right angles; if figures are woven in it is called damask (q.v.). The species of goods which come under the denomination of linen are tablecloths, plain and damasked, cambric, lawn, shirting, sheeting, towels, etc. Linen cloth, or cloth woven of combinations of cotton or other textile fabrics with linen, is printed in the same manner as calico. Fancy cloths are also made by weaving with yarns dyed of various colors, and sometimes with printed yarns. Linen is extensively manufactured in England, Scotland and Ireland. It is also a staple in various parts of Europe.

The beauty of linen consists in the evenness of the thread, its fineness and density. The last of these qualities is sometimes produced by subjecting it to rolling; hence linen with a round thread is preferred to that with a flat thread. The warp or woof is not unfrequently made of cotton yarn, which renders such stuff, called union cloth, less durable; and this is sold in many shops as linen.

Cotton is the chief adulterant, and it is somewhat difficult to distinguish. Wetting with the finger and moistening the material is a popular method tried to detect adulteration: if the moisture absorbs quickly it is linen; but owing to the various weights of linen, it is not an infallible test. An infallible way is to boil a sample to wash out all the dressing and then put it in a 50 per cent solution of caustic soda. The cotton will take on a light yellow color and the linen becomes almost brown. Irish linen is whiter and generally wears best; but the Scottish product for a medium-priced article is greatly in demand. The fragility of French linen confines this beautiful fabric to the wealthier classes. The best Irish and Scottish are sun- and grass-bleached. Sun-bleached linens are the best; artificial bleaching oxidizes and destroys the natural gum which binds the fibres together. The moist and mild climate of Ireland is admirably adapted for the growing of flax and for its manufacture up to bleaching. With a view to protecting the handloom weaver, the British Parliament passed in 1910 the Handloom Weavers Protection Act, under which the words «hand woven» are worked into the selvage of the hand product. From a historical view linen is interesting from its use by several nations in their religious ceremonies. Linen is mentioned in Genesis as in use for robing the royal princes of Egypt; and throughout the Bible it is a symbol of purity and excellence. Linen of 5,000 years ago has been found in Egyptian tombs. The Egyptian and Jewish priests wore it at all their religious ceremonies, hence the former are styled by Ovid and Juvenal, «linen-wearing.» Linen was an article of export from Egypt in the time of Herodotus. From Egypt the use and manufacture of linen probably passed to the Greeks and Romans, but the use of linen did not become common at Rome till late in the history of the republic. The Roman priests wore linen garments at that time. Among the Greeks a linen tunic was a regular part of the male costume as early as the Homer period. Linen was also used as a material for writing, as shown by the Roman *libri lintei*, «linen books.» The mummy bandages, covered with hieroglyphics, are also proofs of this use of linen. In the Middle Ages linen and woolen cloth formed the chief materials for dress, and fine linen was held in very high estimation. Germany and Brabant then carried linen manufactures to the greatest perfection.

The weaving of linen has been practised in Great Britain for a very long period, beginning with the Anglo-Saxon times, but though the manufacture has been much extended since the introduction of machinery, its expansion is limited by the greater cheapness and convenience in many respects of cotton. The English linen industry owed much to Flemish weavers, who settled in England at various times from the 11th or 12th century onward. Flax-spinning machinery was introduced by John Kendrew and Thomas Porthouse, at Darlington, in 1787, and a mill was opened at Glamis in Forfarshire in 1790. The chief seat of the English linen manufacture is Leeds and its neighborhood, where spinning is done on a very extensive scale. A single room in one of the factories at Leeds is said to cover two acres. Ireland and Scotland, however, are much larger manufacturers of linen than England. Of the $40,000,000 worth of linens exported from the United Kingdom in 1913 four-fifths were from Ireland.

Linen was woven in Ireland as early as the 11th century. The manufacture was improved by the refugees who left France on the revocation of the Edict of Nantes and settled at Lisburn and Lurgan on the invitation of William III. The manufacture never really flourished till it was carried on in mills, and by the aid of machinery. The value of linen goods now exported from Ireland to Great Britain is estimated at $40,000,000.

Dundee, Dunfermline and Perth are the seats of the Scotch linen manufacture.

The introduction of machinery in the linen manufacture is of recent origin. It followed the adaptation of machinery to the manufacture of cotton, but as there were some special difficulties to be overcome — such as the want of elasticity on flax yarn — an interval took place between the invention of the various cotton machines and their adaptation to the linen manufacture. The machinery used both in spinning and weaving linen is in general, however, the same as that used for cotton. See Textile Industry, American; Textiles or Textile Fabrics.

Bibliography.— Consult Charley, ‹Flax and its Products› (Belfast 1862); Gibbs, G. M., ‹Household Textiles› (Boston 1912); Leggatt, ‹The Origin and Practice of the Art of Weaving› (London 1893); Moore, A. S., ‹Linen› (ib. 1914); Warden, ‹The Linen Trade, Ancient and Modern› (ib. 1867); Woodhouse and Milne, ‹Jute and Linen Weaving› (2d ed., London 1914).

LINES, Edwin Stevens, American Episcopal Church bishop: b. Naugatuck, Conn., 23 Nov. 1845. He was graduated from Yale in 1872 and two years later at the Berkeley Divinity School, at Middletown, Conn. He was ordained in 1874. He was rector of Christ Church, West Haven, Conn., 1874–79 and of Saint Paul's Church, New Haven, 1879–1903. In November 1903 he was consecrated bishop of the diocese of Newark, which comprises the northern third of New Jersey.

LINES OF FORCE. See Force.

LING, a sea-fish (*Lota molva*), resembling a pike in shape and three to four feet long, but a member of the cod family (*Gadidæ*). It abounds around the British coasts; its fishery approaches in importance and resembles in methods that for cod. Great quantities are preserved by drying, salting, etc.; and an excellent oil is extracted from the liver.

The name is also given to the eel-pout or burbot, another species (*L. vulgaris*) so-called not only in Europe but in northern New York, the Great Lakes and Canada. See Burbot.

LINGA, ling'ga, an emblem commonly used in the sectarian worship of the Hindus. It represents the male or generative power of nature. Originally of an ideal and mythical nature, it has degenerated into practices of the grossest description; thus taking the same course as the similar worship of the Chaldæans, Greeks and other nations. The manner in which the linga is represented is generally inoffensive — a pillar of stone or other cylindrical objects being held as appropriate symbols of the generative power of Siva, the third of the Hindu triad of deities. Its counterpart is «Yoni,» or the symbol of productive female nature. See also Siva.

LINGARD, lĭng'gärd, **John,** English historian: b. Winchester, 5 Feb. 1771; d. Hornby, Lancashire, 17 July 1851. Born of poor parents, he was educated for the Roman Catholic priesthood at Douay. On the passing of the Catholic Relief Act the English Catholic students removed to Crook Hall, where a theological college was erected. Lingard was ordained to the priesthood in 1795, and was vice-president of the Crook Hall seminary near Durham, removing with it to the new college of Saint Cuthbert, Ushaw. In 1811 he declined a professorship at Maynooth, and accepted the charge of the rural mission at Hornby. He published in 1805 ‹Catholic Loyalty Vindicated.› His next work of importance was ‹Antiquities of the Anglo-Saxon Church' (1806). His greatest work, the 'History of England from the Invasion of the Romans to the Year 1688,' printed in eight volumes (1819–30), reached a fifth edition in 1850, when it appeared in 10 volumes. It has since been regarded as a valuable work of reference by historians of all parties. It possesses for Protestant historians the valuable quality of giving the views on controverted points of an able, well-informed and judicially-minded Catholic writer. The 1850 edition of the history was elaborately revised by the author. Apart from the sympathies of the writer, the work is universally regarded as one of high authority. He refused a cardinal's hat offered him by the Pope, but accepted a pension of £300 a year from the queen. Consult Haile and Bonney, 'Life and Letters of John Lingard' (London 1911).

LINGAYÉN, lĭn-gä-yān', Philippines, a pueblo and the capital of the province of Pangasinán, Luzon, situated on a low and fertile island of the delta of the Agno River, formed by one of the outlets of the river and the Gulf of Lingayén. The climate is cool and healthy. It has a fine parish church and the buildings generally are well constructed, many being of stone. The Manila and Dagupan Railroad has a station within eight miles at Dagupan, and Lingayén is the converging point of several important highways and has frequent communication by water with Manila. It has, therefore, an important trade. Pop. 21,529. The city was founded in the 16th century by the Augustine fathers, who handed over the work to the Dominicans in 1611.

LINGAYÉN, Gulf of, an arm of the China Sea indenting the western coast of the island of Luzon, Philippines, north of Manila Bay. The width of the entrance from San Fernando Point to Santiago Island is 20 miles. The east shore is mountainous; the west shore is generally level and less elevated and is fringed by low wooded islands, the channels between which are navigable for native coasters. Typhoons are prevalent in September and October.

LINGG, Hermann von, German epic and lyric poet: b. Lindau, Bavaria, 22 Jan. 1820; d. Munich, 18 June 1905. He attended the gymnasium at Kempten, Bavaria, and (1837–43) the universities of Munich, Berlin, Prague and Freiburg, where he pursued the study of medicine. After obtaining his degree he became a physician in the Bavarian army and served at Augsburg, Straubing and Passau, but fell sick in 1851 and was granted a pension. He retired to Munich, where Geibel introduced him to the poets of the so-called Munich Circle, and obtained an annual stipend from King Maximilian II. Of all the lyric poets of the Munich School, he is one of the most gifted and talented as shown by such poems as 'Immer leiser wird mein Schlummer.' As an epic poet, he is unquestionably their leader, as is shown by his long historical epic, 'Die Völkerwanderung' ('The Migration of Nations,' 1866–68), in stanzas, divided into 25 cantos. Particularly famous is his ballad, 'Der schwarze Tod.' His few attempts as a short-story writer produced perfect results, particularly his 'Byzantinische Novellen' (1881), while his dramatic works (collected edition, Stuttgart 1897) are poor.

LINGUATULA, or TONGUE-WORMS, a highly aberrant parasitic form often classed as an Arachnid. The external appearance of a linguatulid simulates that of a tapeworm, but the structure approximates that of the mites. The adult parasite is found in the nasal cavities or respiratory organs of air breathing vertebrates, chiefly reptiles and mammals; the larva in its first stage a four-legged form of simple structure looking like some mites (*Demodex*) encysts in the connective tissue of various vertebrates and reaches a condition ready for transfer by a period of growth involving several stages. The final host is reached when this encysted larva is eaten with the flesh of its host.

LINGUISTICS. See LANGUAGE, SCIENCE OF.

LINGULA. See BRACHIOPODS.

LINIERS Y BREMONT, Santiago Antonio María de, sän-tē-ä'gō än-tō-nē-ō mä-rē'ä dä'lēn-ē-ārs' ē brā-mōnt, Spanish naval officer: b. Niort (Deux-Sèvres), France, 6 Feb. 1756; d. near Buenos Aires, Argentine Republic, 26 Aug. 1810. After the French Revolution he entered the Spanish naval service, in which he attained captain's rank. He defended Montevideo against the British in 1806, and in 1807 forced them to relinquish Buenos Aires, which they had occupied. The ruling viceroy was then deposed by popular demand, and Liniers selected for the post (16 May 1808). The British soon attacked Buenos Aires, and 1 July gained a battle under its defenses; but Liniers successfully managed the resistance and the enemy, after retreating with large losses, withdrew from the country. He was succeeded in 1809 by Cisneros, whose rule was followed by the revolution of 10 May 1810. Liniers thereupon marched from Cordobá to Buenos Aires for the purpose of quelling the revolt; but was captured and shot.

LINLEY, lĭn'lĭ, **Thomas,** English composer: b. Wells, 1732; d. London, 19 Nov. 1795. He was a pupil of Chilcot at Bath and of Paradies at Naples, became one of the best English vocal instructors, and for several years directed the concerts at the Bath assembly-rooms. In 1774 he became joint director of the Drury Lane oratorios, in 1776 purchased Garrick's share in Drury Lane and in 1776–91 directed the music there. His music contributed greatly to the success of Sheridan's «Duenna,» which was performed 75 times during the season. He also composed the much admired accompaniments to the «Beggar's Opera,» various other music for dramatic works, and glees, canzonets and songs. He obtained high place among English composers through his simplicity and excellent taste.

LINLITHGOW, lĭn-lĭth'gō, Scotland, the county town of Linlithgowshire, 16 miles west of Edinburgh. It is an ancient royal burgh, dating from the reign of David I, with a fine 12th century Gothic church, now restored, and other historical edifices, chief of which is Linlithgow Palace (mostly rebuilt between 1425 and 1628), the birthplace of James V and Mary Stuart, burnt down by the carelessness of the Duke of Cumberland's soldiers in 1746, and now an interesting ruin. In 1570 the Regent Moray was assassinated by Hamilton of Bothwellhaugh. Tanning, shoemaking and distilling are among its industries. Pop. 4,002. Consult Waldie, ‘History of Linlithgow’ (1879).

LINN, William Alexander, American journalist: b. Sussex, N. J., 4 Sept. 1843. He was graduated at Phillips Academy, Andover, Mass., in 1864, at Yale in 1868, and in 1883 was admitted to the New York bar. From 1868 to 1891 he was engaged in newspaper work, during part of that time being on the staff of the New York *Tribune,* and was managing editor of the *Evening Post,* 1891–1900, resigning to devote himself to literary work. He has been president of the Hackensack Mutual Building and Loan Association from its organization in 1887 and was president of the People's National Bank of Hackensack, N. J., from its organization in 1903 to 1916; was president of the First National Bank of Ridgefield Park, N. J., from its organization in 1910 to 1913; elected county collector of Bergen County, N. J., 3 Jan. 1916. Was a member of the New Jersey Commission of 1899 which secured the legislation under which the Palisades Interstate Park Commission, which has saved the Palisades front from destruction, was appointed, and was a member of the latter commission from its organization to 1913. He has published ‘The Story of the Mormons’ (1902); ‘Horace Greeley’ (1903); and ‘Rob and His Gun’ (1902). He is a member of the National Geographic Society, the New Jersey Historical Society, Bergen County Historical Society, and trustee of the Johnson Public Library of Hackensack.

LINNÆUS, lĭ-nē'ŭs, **Carolus,** the Latinized form of the name of Carl von Linne, Swedish botanist: b. Rashult, Småland, 23 May 1707; d. Upsala, 10 Jan. 1778. He showed an early interest in botany; entered the University of Lund, where his botanical tastes were encouraged by Kilian Stobæus, physician to the king, from whose library he was supplied with necessary books. In 1728 he went to Upsala, where he undertook the supervision of the botanic garden. Here he made the acquaintance of the botanist, Rudbeck, whose assistant he became, and assisted Olof Celsius in the preparation of the latter's ‘Hierobotanicon.’ Aided by the Academy of Sciences at Upsala, Linne made a journey about 4,600 miles through Lapland, the result of which was shown in his ‘Flora Lapponica,’ published 1737. In this year he went to the University of Harderwyk in Holland and took an M.D. degree, and later visited Leyden, where he published his first sketch of his ‘Systema Naturæ’ and ‘Fundamenta Botanica.’ In 1736 he visited England, and in September 1738 settled in Stockholm as a physician. He slowly acquired a practice, was made naval physician of Stockholm and obtained some minor appointments. He became professor of medicine at Upsala in 1741, exchanging for that of botany in 1742. He was ennobled in 1761. During his professorship of botany he drew students from all over the civilized world, increasing the number attendant on the university from 500 to 1,500. The importance of Linnæus' work can scarcely be overrated. It has been said that «he found biology a chaos; he left it a cosmos.» He it was who established the systematic botany and zoology of modern times. He first announced the principles for the definition of genera and species, and established the binominal nomenclature of both. He was a careful observer, a methodical worker and a clear and succinct writer. As a teacher he was of great influence in revolutionizing the methods of botanical study. He published more than 180 works, among which the most important are ‘Systema Naturæ’ (1735); ‘Fundamenta Botanica’ (1736); ‘Genera Plantarum’ (1737); ‘Flora Lapponica’ (1737); ‘Classes Plantarum’ (1738); ‘Fauna Suecica’ (1745); ‘Flora Suecica’ (1746); ‘Hortus Upsaliensis’ (1748); ‘Philosophia Botanica’ (1751); and, chief of all, ‘Species Plantarum’ (1753). The Linnæan Society of London was founded in his honor in 1788. Consult ‘Life’ by Stoever (Eng. trans. 1794); Caddy, ‘Through the Fields with Linnæus’ (1877); Fries, ‘Linné, Lefnadsteekning’ (2 vols., Stockholm 1903); Levertin, ‘Carl von Linne’ (ib. 1906).

LINNALITE, a cobalt mineral, Co_3S_4 containing some nickel and copper. Mined formerly in Maryland and Missouri.

LINNELL, lĭn'ĕl, **John,** English painter: b. London, 16 June 1792; d. Redhill, Surrey, 20 Jan. 1882. He began his artistic career as a pupil of West and Varley and was for some time a successful teacher of drawing, numbering among his pupils Mary Wollstonecraft Shelley. He had painted from his 15th year, confining himself exclusively to landscape. Between 1824 and 1838 he produced a number of excellent pictures of this class. Originally an imitator of Gainsborough, he soon developed a brilliant and original style. He was particularly successful in portraying the insular sky scenery of England with its varied cloud forms, and play of sunlight, and his works combine delightful freshness with supreme skill in handling. In the South Kensington Museum is one of his pictures «Girls Gathering Flowers,» and in the National Gallery are his «Wood Cutter,» and «Windmill.» Consult Story, ‘Life of John Linnell’ (1892).

LINNET, a very common and attractive song-bird, one of the smaller migratory finches, of southern Europe and adjacent countries of Africa and Asia. In autumn and winter the plumage is brown-streaked and dull, but in the spring molt; on the approach of the breeding season, the breast and head of the mature male become bright crimson. This gay dress is assumed and put off gradually, and bird-catchers speak of brown, gray, red or rose linnets as if they were separate species, but there is only one—*Linota cannabina.* The name refers to the fondness of the bird for hemp, flax-seed and the like, formerly called the «lint» crops, whence come the Scotch names «lintie,» «lintwhite,» etc., and the English «linnet.» The habits of these birds in the fields are much the same as those of their relatives the American goldfinches, or of the redpolls, called «linnets» in Canada. These are among the most prized of cage-birds for the sake of their song, and are taken in great numbers in traps as well as extensively bred. They will interbreed with the canary and an interesting and valuable hybrid has thus been produced. The song is loud, flute-like and exceedingly agreeable; it consists of several connected strains, and is esteemed by connoisseurs in proportion to the frequency with which certain clear sonorous notes, or «crows,» recur. It sings throughout the year, except when molting, and may be taught various airs and melodies not its own — even to imitate well the complicated song of the nightingale. Such education is rarely given it, however, except in Germany. The care and feeding of a linnet should be the same as those given a canary. See Canary; Cage-Birds.

LINNET-HOLE, in glass-making, a table connecting the glass-melting furnace with the arch.

LINOLEIC ACID, one of the constituents of linseed oil, obtained by saponifying the oil with soda, separating the soap, and decomposing it with chloride of calcium. After washing, the soap is treated with ether, which dissolves the linoleate of calcium. This salt is next decomposed with hydrochloric acid, and the linoleic acid taken up by ether. After distilling off the ether the oily acid remains, which is converted into a barium compound which is purified by crystallization, and from this the acid is finally obtained by addition of sulphuric acid. It is a pale-yellow oil, insoluble in water, but readily soluble in ether. It is lighter than water, has a slight acid reaction and harsh taste.

LINOLEUM, a kind of floor-cloth, introduced in England in 1860. It consists of a mixture of oxidized linseed oil and ground cork spread in a uniform layer upon canvas, the surface of which may be printed in patterns of different colors as in ordinary floor-cloth. The oxidizing of the linseed oil, by which process it becomes a caoutchouc-like substance possessing a certain amount of elasticity, is effected by exposing it in thin films to the influence of air. Certain proportions of kaurigum, resin and pigments, according to the ground color desired, are added to the oxidized oil, which is then intimately mixed with the ground cork, and firmly squeezed on and rendered adherent to the surface of a rough canvas backing, which is afterward coated or waterproofed with oil paint. In inlaid linoleum the pattern goes right through the fabric, the different patterns being pieced together and then rolled over with heated rolls. An embossed linoleum, washable, waterproof and warm, invented by Frederick Walton as a substitute for wall paper, is named after him «Lincrusta Walton.»

LINOTYPE, The. See Composing Machines.

LINSANG, one of the beautiful spotted civets of the Oriental genus *Prionodon*, of which various species are to be found from northern India to Borneo. The West African linsang (*Poiana poënsis*) is a rare species from the Fernando Po district, closely allied to the Malayan ones. They have the general characteristics and habits of the civets (q.v.) but are especially expert in tree-climbing and feed mainly upon birds.

LINSEED, or **LINSEED MEAL.** See Flaxseed.

LINSEED OIL INDUSTRY, The. In the commercial world there are known at the present time a number of vegetable oils, which in the raw state and without the aid of chemicals are capable of absorbing the oxygen of the air to a greater or less degree and becoming solid. These are commonly called «drying oils.» By far the most valuable to commerce, both as to usage and results obtained, is linseed oil, expressed from the seed of the plant *Linum usitatissimum*, the common flax. In early times the object of its cultivation was principally for the flax fibre. Although the great economic importance of linseed oil, due to the large increase of manufactured products in which it is used, has been of but comparatively recent years in this country, the seed or plant bears the hall mark of great antiquity. It is positively known that drying oils had been discovered prior to the Christian era, and, though uncertain, it would seem reasonable to assume that linseed oil was among them. For centuries it appears that the oil's greatest characteristic, its wonderful drying properties, was given little attention. It was not until the 12th century, when oil painting was discovered, that we may say a true appreciation of the essentially exclusive properties of linseed was felt, and from that day to this it is the only oil that has successfully satisfied all the requirements of oil painting.

Manufacturing.— In earlier years the small amount required, principally by the artists, was produced by little, if any, apparatus, and often in the studio. Later, the oil began to find enlarged fields of usefulness, and the crudest of mechanical apparatus was devised for its manufacture. With such appliances, however, oil could be produced only at an excessive cost, and its use on a broad commercial basis was not feasible. Indeed, up to within comparatively recent years the invention and improvement of linseed oil machinery has been slow, and in fact to the United States may be attributed the greater part of the advance made in this industry in the past 100 years. The earliest method recorded for the production of linseed oil is a receipt by Theophilus, a monk writing in the 12th century, and which becomes particularly interesting when we find that the treatment of the seed or method was almost identically the same as it is to-day. «Take linseed and dry it in a pan without water, on the fire; put it in a mortar and pound to a fine powder; then replace it in the pan, and pouring a little water on it, make it quite hot. Afterward, wrap it in a piece of new linen, place it in a press used for extracting the oil of olives, of walnuts, or of the poppy, and express it in the same manner.» It will be seen from the above that the seed was treated separately four times, as follows: Dried, crushed, cooked and pressed. With the exception of the drying, which is not necessary, the plan of procedure to-day is the same. During the intervening years, however, many different methods have been used as well as different kinds of machinery.

In the making of linseed oil there are two very essential steps which must be carefully watched; the first is the crushing or grinding of the seed; the second is the cooking or «tempering» of the ground seed. In the proper manipulation of these two processes rests a crusher's ability to make a good yield of oil. Heat and moisture are of the greatest importance in producing the best yields; we find, in fact, that many times the ground seed or meal was pressed entirely without cooking. Oil made in this manner was called «cold pressed» oil. In the cold process the oil expressed is beautifully light in color and heavy in body; furthermore, upon boiling to a high temperature the oil does not darken but becomes lighter, and after mixing with the varnishes is perfectly clear and without sediment. On the contrary, oil made from the tempered meal is thinner and darker in color; on boiling at high temperatures it darkens still more, and throws down a quantity of white and greasy precipitate. Owing to the light yield of oil in the cold process, however, the cost is excessive and little is now made.

The first attempt to manufacture linseed oil in quantities was by the ancient screw and lever press, a modification of the old cider press. It consisted of a barrel, sometimes of cast iron, perforated to give a free outlet to the oil, and fitted with a plunger which, when actuated by the screw, descended into the open barrel upon the mass of meal contained therein, and by means of slow pressure expressed a reasonable amount of oil. This press was worked by a hand lever placed through an eye at the head of the screw, like a bar in a capstan. Little oil was secured, however, in comparison with presses actuated by machinery. On this account considerable oil remained in the dry residue known as oil cake; these "cakes" weighed about 25 pounds each and were about 18 inches in diameter by 8 inches thick, resembling a cheese in shape and thus giving to it the name of "Cheese Box" press. The capacity of this press was less than one barrel of oil a day. The screw and lever press was retained in use as late as 1848. Some years prior to that date, however, the improved Dutch mill or wedge press had come into vogue. These mills were imported from Holland, and were considered a great improvement over the old screw and lever presses. The wedge press consisted of a very heavy rectangular frame work of oak or iron, placed horizontally on its base. The ground seed was shoveled by hand into woolen bags and these were hung vertically between hinged partitions, consisting of wooden plates. The capacity of the press was about 9 or 10 of these bags, giving a daily pressing of not over 15 to 20 bushels. The cakes left in this press weighed from 8 to 10 pounds each, after the raw edges had been trimmed. The pressure requisite for the expression of the oil was obtained by driving wooden wedges between the plates by means of sledges driven by wind or water power. This press was still in use in 1853.

The wedge press was discarded for the horizontal hydraulic press, the next step in the advancement of the industry and undoubtedly the most important. Probably the first hydraulic presses used in the United States for linseed oil were those installed in a New York mill shortly after the War of 1812. In these the plates were of iron instead of wood, and movable; the ground seed was shoveled into the woolen bags as before, flattened by the hand of the workman, and placed in mats of horsehair, which were folded in book form. After placing in the press vertically, one at a time, the iron plates were moved up against each bag, when the ram of the hydraulic cylinder moving horizontally compressed the eight or nine cakes contained in the press, the oil running into a trough or pan beneath. The yield of oil was very much increased by this method. The horizontal press, however, had its disadvantages, and in 1851 the first patents for vertical hydraulic presses for linseed oil were granted. The capacity was not increased over the horizontal type at first, the press holding only 6 to 10 cakes. The clumsy and unwieldy manner of packing the meal in the bags and filling the presses, however, was done away with. What is known as "boxes" were used, the ground seed being molded into soft cakes, packed in wrappers and placed in the press, one above the other, the boxes acting as shelves. A large saving was made here in labor and time, necessarily resulting in considerable increase of daily capacity and consequent reduction in the cost. With the improvements in the manner of pressing the seed came improvements in grinding or crushing. Linseed was crushed first in this country by rolling through a mill worked by hand; the rollers in this mill consisted of one large and one small, the seed being passed through once or twice, according to the views of the crusher. The earliest method for reducing the linseed to meal by machinery was that used in connection with the Dutch mill or wedge press, and was called the "Tamper" mill. This was a mortar and pestle on a large scale. The mortars were of heavy cast iron, the bottom flat on the inside and holding a small amount of flax seed; the pestle was an iron-shod log, standing vertically in a frame, the foot resting on the bottom of the mortar; these logs, weighing from 150 to 200 pounds each, were raised, by means of cams on a horizontal shaft, by water or wind power, and falling of their own weight exerted a crushing or grinding force upon the seed. The tampers, as they were called, numbered one or more in the set. The capacity of a mill was necessarily cut down very much by such a slow process, and rolls run by machinery were resorted to; these were of different design from the old hand rolls, and were designated in the trade as "cracker" rolls, for the reason that they cracked or opened the seeds. These rolls were arranged in pairs only and varied in size from 12 to 18 inches in diameter and 7 to 18 long, according to the views of the manufacturer. After being bruised in these rolls, the seed was placed in an edge-runner or chaser, also known as a muller. This consisted of a circular trench of iron, several feet in diameter, placed horizontally on a firm foundation. Running around this, like wagon wheels in a rut, were two ponderous iron-shod wheels, 5 to 6 feet in diameter with steel tires 10 to 16 inches wide. These were sometimes made of stone and set opposite one another on a shaft and weighed about 7,000 pounds each. Around and around these wheels revolved, chasing one another until the meal was finely crushed and rolled, when water was added until the meal acquired the consistency of putty, or what was termed "dobby." It was then mixed or "mulled" for some 10 or 15 minutes and then tempered with heat. These muller stones proved very satisfactory as to results, but were clumsy and took a great deal of power; furthermore, the expense of two grindings was unnecessary. Nevertheless, no change was made for many years.

The tempering or cooking of the crushed seed having such an important bearing on the yield of oil has also suffered many changes. There was considerable variation in the temperature used, from cold to hot, according to the manufacturer. Often the spontaneous heat of the crushing was considered sufficient. In the tamper of the Dutch mill water was played on the meal in the mortar, when vapors began to arise, in order to keep it from getting too hot and thus spoiling the oil. No further tempering was considered necessary. Later, however, and notably in connection with the muller stones regular cookers began to be used; these were heavy sheet iron drums or tanks, slowly revolving over a charcoal fire until the proper temperature was attained. With the advent of the hydraulic press, improvements were made in cooking devices and stationary heaters began to be used in which the meal was cooked by steam. Up to the year 1856, and as related, the cooked meal was placed in the bags by hand; at this date, however, a device was patented to form the cooked meal into soft cakes or molds preparatory to placing them into the cloth or wrapper which was to take the place of the bags originally used. This was considered a great boon, saving as it did the laborious process of handling and molding the meal by hand to fit the press; though somewhat clumsy at that time, the «molder» or «former» has been much improved. Where in former years the molder was run by power from the shaft, now hydraulic pressure is utilized, and the «former» is in reality a miniature press, consisting of a square mold or box into which a plunger presses the required amount of meal. Very light pressure is sufficient, and it is so arranged that the cooked meal will not be compressed to the point where the oil is separated.

The tempering, crushing and pressing of linseed was carried on, with a few exceptions, substantially as related up to the year 1878, when the most lasting improvement to oil machinery was made, and which introduced practically the system in use at the present time; namely, the automatic «Lawther» process. Greater economy was immediately secured and larger yields of oil. The old muller stones and cracker rolls gave way to the stack of «four or five high» chilled iron rolls, by means of which the seed was bruised three or four times in passing through. Apparatus for controlling and regulating the high pressure was introduced; kettles or cookers were steam jacketed and had larger heating area, and steam was fed into the meal to moisten as well as heat it. The plate press had also been given the preference over the box press, which was clumsy. Although the very best mills to-day have some improvements over the original Lawther process, they make rather toward greater economy than increase of yield. The modus operandi in the largest and most complete mill to-day is as follows: The flax seed is first thoroughly cleaned by separators and dust collectors until the original dirt, amounting to 10 or 20 per cent, has been reduced to less than 1 per cent. This seed is now passed through the rolls, there being about one set of five rolls high to every three presses. The crushed seed falling from these rolls is led by screw conveyors into the steam jacketed cookers of large capacity and holding a considerable quantity, where it is tempered. This consists of heating the ground seed to a temperature of from 120° to 180° F., according to the quality of the seed used, and moistened with live steam, all the time being kept in constant motion to prevent burning. When the temper is considered perfect a batch is made. This consists of drawing off the cooked meal on to the formers and molding the cake. A piece of cloth somewhat wider than the molded cake is placed so that the tempered meal may be drawn out onto it. This cloth or wrapper, as it is called, is a substitute for the horse hair cloth and woolen bags of former days, but now made of pure camel's hair to stand the high heat and enormous pressure. By a single motion the former is now closed and immediately reopened, when the ends of the cloth protruding are automatically wrapped around the soft cake and it is placed in the press (by automatic nippers, in the Lawther press). The batch makes 20 of these cakes, which fills one press. The pressure is now turned on by an automatic valve or change cock which slowly increases the pressure up to about 4,000 pounds to the square inch. This enormous pressure is generated by very powerful hydraulic pumps, connected to what is known as the accumulator system, the first pressure being up to 800 pounds per square inch and the second from 2,600 to 4,000 pounds. The accumulators are for two purposes; first, to act similar to a safety valve on a boiler, preventing the pressure from exceeding the limit; secondly, keeping the pressure at a steady level throughout the time the seed is in the press. Before the adaptation of the accumulator and change cock, the oil was pumped directly into the press, causing an unequal flow and consequent reduction in the yield of oil. Six presses are generally grouped, one being emptied and refilled every 10 minutes, the six thus completing one hour in time and allowing each press in the group to drain every 50 minutes. In some mills seven batches are made instead of six, and the weight of the cake is also increased from 11 and 12 to 14 pounds. This is done in order to increase the capacity of the mill, but generally at a sacrifice in the percentage of oil. As each batch is removed from the press, the camel's hair cloth wrapper is stripped off, the rough edges of the cake trimmed automatically, and the cake piled up in the cake house, where it is allowed to dry for at least 48 hours. The raw oil, after having been run from the settling troughs at the back of the presses, is carefully filtered and placed in tanks ready for barreling.

An improvement over the intermittent action of the simple hydraulic press was the Anderson continuous action press, appearing in 1905. In this machine the seed, ground or unground, is pressed in a perforated cylinder of hardened steel by a series of revolving screws, the oil dripping from the perforations, and the residue being expelled as dry meal at the farther end of the machine. The seed may be heated to not more than 140°, or pressed cold. The product is of the finest quality, suitable for the best varnishes. The Anderson machine has a capacity of about eight bushels per hour.

While probably four-fifths of the total linseed oil output of the United States is manufactured in some kind of a press, by what is termed the «old process» (as above described), the remaining fifth is made by the «new process,» in which naphtha is used as a solvent of the oil. The seed is first thoroughly crushed as in the old process and is heated, but without any added moisture. In fact the heater is so arranged as to drive off the natural moisture of the seed. The crushed seed is placed in a jacketed cylinder called a percolator, 1,000 bushels at a time. Naphtha, heated by passing through a coil feed water heater, is run in on top of the linseed, and steam is let into the percolator jacket to keep up the heat. The naphtha with its content of dissolved oil is drained off from time to time into a condensing tank, where the naphtha is boiled off, the vapor passing to a cold condenser, and thence back to the naphtha reservoir. The separated oil is carried to an open tank where it is heated and subjected to a vigorous air blast to remove any lingering odor of the naphtha. The operation is continued with each charge of seed for three days. The residue in the percolator is then treated with live steam, and again leached with hot naphtha. This treatment reduces the oil left in the meal to about 1½ per cent. The product ranks with the best on the market. The plant for this process costs about 25 per cent less than for the old process, and the profits are more than 60 per cent greater.

The Oil and Its Uses.— Linseed oil as manufactured may be classified under three headings: raw, boiled and refined. Raw linseed oil is the term applied to oil as it comes from the press in its original state. The principal consumer of raw linseed oil is the paint grinder; as it was used as a vehicle for paint hundreds of years ago, so it is used now. Every year millions of gallons are spread on buildings in the form of mixed paints, one concern alone using over 1,500,000 gallons yearly. Every 100 pounds of white lead requires at least 7½ gallons. Boiled linseed oil is, as the name denotes, raw oil boiled over a fire, chemicals being added, the object being to increase its drying properties. Many formulas are used by the different crushers for making boiled oil, the oldest and most reliable, however, containing principally red lead and black oxide of manganese, the addition of these substances to the heated oil stimulating the linolein and increasing its affinity for oxygen. The uses for boiled oil are many and varied, but it is principally used as the quick drying oil in paints. The refined or varnish oils are many, and there is the greatest rivalry to-day among oil manufacturers as to the qualities of their respective varnish oils. Hundreds of thousands of gallons of these oils are used every year. While the different gums used in the manufacture of varnishes are the basis or foundation, some variety of refined oil is the most important component of the varnish. As stated before, raw linseed oil has certain component parts which must be removed and all tendency to «break» must be eliminated. Descriptions, however, of these methods will not be attempted, as they pertain more particularly to the chemistry of linseed oil and not to its manufacture. The reliable varnish oils are few and are furnished only by the largest manufacturers. Linseed oil in some form plays a very prominent part in the manufacture of linoleum and oil cloths also. Varnish oils are used in the manufacture of patent leather, for shoes and other purposes, carriage tops, and all kinds of dressed leathers are finished with linseed oil. The oil clothing worn by sailors and fishermen is soaked with it. It appears by the thousands of gallons before our eyes in the printers' ink on newspapers, and smaller quantities are used in the manufacture of oil silks. Linseed oil has no value as an edible oil, or as an illuminant or lubricant. While not very large in comparison with other industries, the consumption of linseed oil in the last few years as compared to former years has increased very rapidly, and at the present time the above industries consume annually an amount computed at nearly 62,000,000 gallons. The price of linseed oil is of course governed by the cost of manufacture and principally by the price of seed and cake. The greatest fluctuation experienced in earlier years was in 1867, when oil went from $1 per gallon to $2.03, and in later years, in 1901, when it went from 50 to 82 cents per gallon. Linseed oil has always been subject to great fluctuations, and it will be seen by averaging that from 1876 the annual fluctuation has been about 14½ cents per gallon, the smallest fluctuation known being in 1883, when there was only three cents difference in price at any time during the year. On 15 June 1917 the prices in the New York market for five-barrel lots were raw oil, $1.21 per gallon; boiled oil, $1.22 per gallon; refined oil, $1.23 per gallon.

The Cake and Its Uses.— While really a by-product, the manufacture and sale of the cake is equal in importance to the sale of the oil, and although netting a smaller price per pound, the value has a very great influence on the course of oil prices and the policy of the business as a unit. Practically the only use for cake is as a food for livestock, principally cattle, for fattening and for results in the dairy. The actual protein in cake is about 36 per cent, of which about 85 per cent is digestible, and the nutritive value is consequently about four times that of hay, while the fat varies from 4 per cent to 8 per cent, according to the crusher. Although used extensively abroad, it is a singular fact that our farmers in the United States have little, if any, appreciation of its value. Our own country should be the largest consumer of this most valuable by-product; actual figures, however, show that only about 20 per cent is retained for home consumption. The first cost is somewhat greater than for other food stuffs, and our farmers as a general rule lack the knowledge of its value, which comes only by experiment and valuable experience. The manurial value alone of linseed oil cake has been estimated at over $16 per ton, whereas the first cost is only from $18 to $25 per ton. Our farmers, it is true, are waking up to its value and more is being used in this country every year, but the bulk of our output is taken by Holland and Belgium with France third. The exportation of cake has grown with the industry and the proportion of export remains practically the same, with the exception that each year a little larger part is retained for home consumption. The total exports in 1895 were about 120,000 tons, and in 1913 about 290,000 tons. A glance at the figures will show that of the total 290,000 tons the three countries above mentioned consumed 242,000 tons, the balance being divided largely between France and Germany with 18,000 tons each, Canada and West Indies 5,000 each, and Norway, Sweden and Denmark insignificant amounts.

Growth of the Industry.— To the early settlers the flax plant was of value for the flax and not for the seed and oil. In 1719 the spinning wheel was first introduced in New Hampshire by the Protestant Irish who settled there, and flax was grown more abundantly. The seed was for the most part exported, a few thousand bushels being sufficient to supply the domestic demand. The first impetus to the growth of flax for linen fabrics and consequent increase in seed and oil was given in 1722, when bounties for its growth were granted. The increase was immediate, and the plan worked so well that the bounties were continued, and in fact increased, until in 1751 we find it reported that 60 wagon loads of seed were exported at Baltimore. In 1752 a further increase was noted, 10,000 hogsheads or 70,000 bushels of seed being exported from Philadelphia. Twenty years later, 110,000 bushels were sold abroad, and in 1791 292,000 bushels, or upwards of one-half of the total crop of the United States in 1860, which was 567,000 bushels. Some idea of the rapid growth of the oil industry after the Revolution will be gained from the fact that in 1791 only 450 gallons were exported, while in 1795 nearly 50,000 gallons were sent abroad, an amount which was not again equaled until 60 years later. In 1792 the invention of the cotton gin placed a severe check on the growth of flax for the fibre, cheapening as it did cotton and cotton fabric. Undoubtedly at this time closer attention was paid to the flax seed for its oil-bearing seed; the business was a profitable one, as had been shown by the small export business done. From 1795 the export steadily decreased, showing ever-increasing home consumption, and in fact considerable quantities were now being imported. From about 80,000 gallons in 1825, the imports increased to 3,200,000 gallons in 1867. Immediately after this, however, the imports dropped to an insignificant quantity, and have continued so to this day, a certain quantity of Calcutta oil only being imported each year at high prices, for special uses, it being a well-known fact that the finest oil in the world is made from East Indian seed. In 1839 the first cargo of flax seed was imported, and importations have increased to the figure of 10,666,215 bushels for 1916 — most of which came from Argentina. From 1880, when the crop grown in this country aggregated some 7,000,000 bushels, the crop increased to at least 30,000,000 bushels in 1903. The average for recent years has been about 15,000,000 bushels each year. The production of flax seed in the United States in 1916 amounted to 15,459,000 bushels. Of this total North Dakota produced 8,137,000 bushels; Montana, 3,088,000 bushels; Minnesota, 2,338,000 bushels, and South Dakota, 1,395,000 bushels. Iowa and Kansas each produced about 150,000 bushels. The total value of the crop, as estimated at the price ruling on 1 Oct. 1916, was $38,350,000. The average consumption amounted to 8,000,000 to 10,000,000 bushels of seed up to about the year 1892. From that time the statistics show a steady increase in the consumption, until about the year 1916 the amount crushed was a little over 26,000,000 bushels, yielding about 25,000,000 gallons of oil.

Price of Seed.— While at times the fluctuation of seed prices has been caused by speculation and manipulation, the law of supply and demand has generally fixed the value. In 1885 Cincinnati was the principal centre for the sale of the seed. From about 1870 Chicago became the great market, its location being more central. Ten years later, however, Chicago lost its prestige, and Duluth became practically the only market. Since then Minneapolis has divided the honor with Duluth. The highest price obtained for flaxseed in modern times was in 1862, when sales were made on a basis of $3.25 per bushel. From 1862 to 1874 seed never sold under $2 per bushel but averaged about $2.50; after 1874, however, prices steadily declined until 1886, when $1.03 was reached. The lowest price ever obtained was in 1897, when seed went to about 63 cents. The greatest fluctuation was in 1862, seed going from $1.25 to $3.25. The average farm value of flaxseed for 1916 was $1.99 per bushel, and on 1 May 1917 the price reached $3 per bushel. In earlier times, almost all the seed was grown in the Eastern States; large amounts were grown in New York, whereas now scarcely any is grown there. Ohio long held a good share of the crop; from Ohio it traveled to Indiana and Illinois; then to Kansas and Iowa; and from there to Minnesota and Dakota, and finally, in the last few years, almost the entire crop has been grown in North Dakota, South Dakota, Minnesota and Montana. The historical records furnish us with very meagre data as regards the number of mills in operation at different periods. In 1810, the census tells us there were 383 mills in 14 States, 171 in Pennsylvania alone. These mills were small affairs, but the number is conclusive of the large interest taken in this industry. These mills made 770,000 gallons of oil, valued at about $900,000. In 1860 there were 94 mills, turning out nearly $6,000,000 worth of oil and cake; in 1870 the number of mills was reduced to 85, but the value of the products had increased to $9,000,000 worth of oil and cake, and in 1880, 81 mills produced $15,400,000 worth of products. The number of mills was still further reduced in 1890 to 62, making $23,500,000 worth of oil and cake, and in 1900 48 mills were producing a value of nearly $30,000,000. The steady decrease in the number of plants in operation is due to the inability of plants with old-fashioned machinery to work on the lowest basis of cost manufacture.

According to the 1914 census of manufactures there were in that year in the United States 25 linseed oil mills of factory grade, employing 1,488 wage earners receiving annually a total of $1,127,000 in wages. The capital invested amounted to $39,873,000, and the value of the year's output was $44,882,000: of this, $5,327,000 was the value added by manufacture. The yield of linseed oil was 24,481,623 gallons. More of the crushing is done at Minneapolis and Saint Paul than at any other locality in the United States, though there are important mills also at Chicago, Cleveland, Toledo, Buffalo, New York and Philadelphia. Exports for the calendar year 1916 amounted to 824,052 gallons of oil and 667,645,566 pounds of oil cake. Consult Ennis, W. D., 'Linseed Oil and Other Oils' (New York 1909); United States Department of Agriculture, 'Farmers' Bulletin 785' (Washington 1916).

LINSEY, the name of an English country-made fabric of linen warp and worsted filling.

LINSEY-WOOLSEY, a mixed fabric made of linen and wool.

LINSLEY, James Harvey, American naturalist: b. Northford, Conn., 5 May 1787; d. Stratford, Conn., 26 Dec. 1843. He was graduated from Yale College in 1817, and became a Baptist clergyman, but on account of ill-health resigned from the pulpit and devoted himself to the study of natural history. Many catalogues of mammalia and birds from his pen may be found in the *American Journal of Science*.

LINSLEY, Joel Harvey, American clergyman: b. Cornwall, Vt., 15 July 1790; d. Greenwich, Conn., 22 March 1868. He was graduated from Middlebury College in 1811, and was tutor there for three years; afterward studied law, but in 1822 was licensed as a Congregational clergyman and went to South Carolina as a missionary. During the years 1824–32 he was pastor of a church in Hartford, Conn., and was at Park Street Church, Boston, 1832–35. In the latter year he was elected president of Marietta College, Ohio, which post he held 10 years, raising a considerable fund for the institution.

LINSTOCK, a gunner's forked staff to hold a match of lint dipped in saltpeter.

LINT, in surgery, the scrapings or ravelings of fine linen, made into a sort of cloth and used by surgeons in dressing wounds. It is prepared in various forms, which have different names, according to the difference of the figures. Lint made up in an oval or obicular form is called a pledget; if in a cylindrical form or in shape of a date or olive-stone, a dossil. The advantages of this material for the purposes for which it is used are very great owing to its softness of texture, the ease with which it may be folded or rolled into any shape required, its capacity to absorb discharges, and its cheapness, on account of which it may be thrown away when once used. For modern surgery it is rendered antiseptic by steeping in carbolic acid, perchloride of mercury solution, etc., and subsequent drying.

LINT-DOCTOR, a sharp-edged ruler on the delivery side of the calico-printing cylinder, to detain any lint or fibres which may come off the cotton cloth.

LINTEL, in architecture, a horizontal timber or stone over a door, window or other opening, to support the superincumbent weight.

LINTON, Eliza Lynn, English novelist: b. Keswick, Cumberland, 10 Feb. 1822; d. London, 14 July 1898. In 1858 she married William James Linton (q.v.), but they separated in 1867, though continuing to maintain friendly relations until his death. She was connected with the press for nearly all her literary career, writing for the *Saturday Review,* the celebrated 'Girl of the Period' papers. She sometimes dipped her pen in acid, but in private she was warm-hearted and self-sacrificing. Among her numerous works are 'The World Well Lost'; 'The One Too Many'; 'In Haste and at Leisure'; 'The Girl of the Period,' etc. Her best novels are 'The True History of Joshua Davidson: Christian and Communist' (1872), and 'Autobiography of Christopher Kirkland.'

LINTON, Sir James Dromgole, English painter: b. London, 26 Dec. 1840. He was educated at Cleveland House, Barnes. He afterward studied art and has done much to promote the interests of the English school of water-color painting. He was elected a member of Institute of Water-Color Painters (1867). When it was reorganized its title being henceforth the Royal Institute of Painters in Water-Colors, he was chosen president (1884). In the following year he was knighted. His pictures in oil include the 'Marriage of the Duke of Albany,' painted in 1885, and a series of panels illustrating 16th century history for a private mansion at Nottingham.

LINTON, William James, Anglo-American wood engraver and author: b. London, 1812; d. near New Haven, Conn., 29 Dec. 1897. As a wood engraver he took very high rank, and some of his finest work may be found in the pages of the *Illustrated London News,* to which he frequently contributed from its commencement till he came to the United States in 1867. As an author, in which capacity he was more widely known than as an engraver, the zealous Chartism of his youth tinged much of his earlier production. Among his works may be mentioned 'The Plain of Freedom' (1852); 'Claribel and other Poems' (1865); 'The English Republic'; 'Some Practical Hints on Wood Engraving' (1879); 'Life of Thomas Paine' (1879); 'A Manual of Wood Engraving' (1884); 'Poems and Translations' (1889), and 'The Masters of Wood Engraving' (1890).

LINZ, lints, Austria, the capital of the Crownland of Upper Austria, on the Danube, 98 miles west of Vienna (117 by rail). It is defended by detached forts extending over a circuit of nine miles, and has an old cathedral, a new cathedral, provincial parliamentary house, castle, town-house, bishop's palace, etc. The manufactures include woolen, linen, silk and cotton goods, locomotive machinery, lamps and hardware, tobacco factory and shipbuilding, and there is an extensive trade on the Danube, on which steamers ply upstream to Ratisbon and down to Vienna. Pop. 67,817, the majority German Catholics.

LION, the largest and most celebrated of the cat tribe, forming the widespread species *Felis leo*. The outward form and appearance of the lion are familiar. The apparently excessive size of the head, due chiefly to the great mane which covers the head, neck and shoulders of the males; the uniform, unmarked, tawny color of the skin; the great development of horny papillæ upon the rasp-like tongue; the growth of long hair on the elbows and along the middle line of the belly, and the tuft at the extremity of the tail (hiding a horny spine) are distinctive external characters. The length of the lion from nose to tip of tail, rarely, if ever, exceeds 10 feet, and that of the lioness nine feet, of which the tail forms a third. The older books separated a supposed species of maneless lion, especially one in India designated the maneless lion of Gujerat; but the development of the mane varies greatly, some lions in all regions having this feature much more abundant than others, and in all cases it is a product of age, appearing fully only when the animal has reached full maturity at the age of five to seven years, so that no distinction of this kind is valid; nor can any be made upon color, the mane in certain specimens being very much darker than in others without regard to locality, dark and amply maned and scantily maned individuals belonging sometimes to the same litter. The period of gestation in the lions is five months. Only one brood is produced annually, and from two to four young are produced at a birth. They remain where born for a few weeks; the mother may leave them for 48 hours to go hunting. The mother nourishes the whelps for about a year; their size at birth being about that of a pug-dog. In their young state the whelps may be marked with various markings; brown bands upon a tawny body color and a stripe along the spine being most frequently observed. As they grow older, however, the markings disappear, and the uniform tawny hue of the adult is reached. The probable limit of age of the lion has been differently stated by different writers. Buffon fixed it at 22 years. But a lion which died in the Tower of London in 1760 had lived in captivity above 70 years.

The habits of lions have been observed and described by more writers than in the case, perhaps, of any other animal, and they are known to vary constantly with circumstances, locality and the kind of prey available. In general this heavy animal, which is entirely unable to climb into trees, and frequents open rather than forested regions, gains its food by stealth and power rather than by agility and speed, and kills his quarry most frequently by stalking rather than by waiting at watering places. Lions often go abroad by day, wandering and hunting widely, but are chiefly active at night. Then this great cat goes to some accustomed lurking place near a spring or by the side of a river, where, concealed among the brushwood, he lies in wait for the animals coming to drink. A single powerful leap generally lands him upon his prey which is crushed down by the weight of the attack and mauled and bitten about the head until the neck is broken by a wrench or the veins and arteries are torn open. If no rivals are near and the animal is very hungry, the prey may be devoured on the spot to the extent required to satisfy appetite; and then, after drinking copiously, the beast will usually go away to his lair, leaving the remains for his family, if they have come near (as often happens), or to hyenas and jackals. In most cases, however, the lion, like other great cats, chooses to take his quarry to some retired spot where he may feed upon it unobserved; and amazing stories are told, with apparent truth, of the strength displayed in carrying or dragging the carcasses of large antelopes, cattle and horses; it is not to be believed, however, as sometimes has been asserted, that a lion is able to «fling a bullock over its shoulder» and run away with it. Such a feat is limited to goats and small animals, if, indeed, it ever occurs. Lions sometimes hunt together for mutual support. The lioness hunts by herself, especially when her kittens are young, at which time the father of the family is wandering alone, or with other males, and would be resisted if he attempted to join his spouse. The young remain with the mother until they are full-grown. The lion alone among cats is regularly polygamous, each male having three or four lionesses whose allegiance he gains by prowess in battle over rivals, and keeps by killing or driving off all newcomers. The result of these constant encounters in the arena of the desert is not only a scarcity of males but the continuous selection of the best to become progenitors of the race. One peculiarity of the lion developed by this incessant warfare among the males is the development of the defiant and terrifying voice which elevates the growl, and enlarges the scream, of other cats, into a tremendous roar — a volume of noise beyond that made by any other animal. The statement that the lion roars at stated periods appears to be almost wholly without foundation; in summer alone, and especially before storms, the lion roars before dawn. In rage the lion beats his sides with his tail, agitates his mane and facial muscles, protrudes the tongue and claws, utters the peculiar sharp, frequent growl and altogether presents a very terrific appearance, all of which, primarily, has reference to the savage rivalry of males above described.

The natural disposition of all animals to get their food as easily as possible has led lions everywhere to prey upon domestic cattle which, in a region where they are numerous, suffer nightly despoliation. Lions that have discovered this comparatively easy method of supplying their wants soon learn that mankind is equally, or even more, readily obtainable, and become «man-eaters.» Beasts so sophisticated must be put out of the way; and barbarians organize great bands of men who learn the lair of the animal, surround it and effect the animal's death by any rude means possible. «Man-eaters» are generally old, but occasionally they are in the prime of life and vigor. During the building of the Uganda Railway two lions thus attained celebrity through their depredations among the construction gangs, until shot by the engineer in charge, and were known as the «man-eaters» of Tsavo. Some savage hunters boldly and skilfully overcome the lion almost in single combat, with rude weapons; but, with perhaps the exception of the tiger, he is the most dangerous of quarries. A charging lion will take half a dozen shots from a heavy gun, each of which ultimately prove fatal, and yet have strength left to maul an assailant. There are four methods of stalking: tracking on foot; hunting on horseback and dismounting to shoot; hunting with dogs, and shooting from shelters by water holes or over hills. The incessant persecution to which the lion is subjected whenever a region begins to become civilized has exterminated it over a large part of the former domain of the species. When men began to hunt in Europe in the Stone Age they found there lions whose remains, entombed in the floors of caves, are called those of «cave lions» (*F. spelæus*), but which present no important differences from the modern species. Within the time of written history lions dwelt in the mountains of southwestern Europe, and many of those seen in Rome in the time of the earlier Cæsars were obtained from the Danube Valley and Asia Minor. The supply was soon exhausted, however, and the later demand was met by importations from the Caucasus and southward, but mainly from northern Africa. In the arenas of ancient Rome large numbers of lions were frequently exhibited. Sulla, the dictator, once exhibited 100 of these animals, and Pompey presented 600 in the circus; Hadrian caused 100 to be destroyed at one exhibition, and others of the emperors and consuls were equally prodigal. In order to provide these great quantities laws were promulgated protecting the beasts in the Carthaginian provinces, to the great detriment of agriculture there and risk of the peasantry, and breeding establishments were created to produce enough lions to meet the imperial demand. The taming and training of lions have continued ever since, and to-day this great shaggy cat is the most impressive, if not the most intelligent, of the troupe which the menagerie showman gathers about him. For a long period almost all the lions exhibited in zoological gardens and shows have been those born in captivity, where the species breeds freely.

At the present day few lions exist north of the Soudan and Abyssinia; a few are left in the recesses of the Atlas Mountains; British and Portuguese East Africa and Rhodesia are the chief hunting grounds left; and they have become extinct or scarce in the civilized regions of South Africa. In 1850 the last lion in the vicinity of Cape Town was shot. They no longer exist in Asia Minor, but are numerous in the extensive marshes along the lower Euphrates and Tigris, and thence occur at intervals to the valleys of the Indus, where a few still remain in the wilder deserts of Cutch and Gujerat. Formerly they were known over all northern and western India.

Books of special value relating to lions and lion hunting are Flower and Lydekker's 'Mammals, Living and Extinct'; Blanford's 'Zoologies' (of India, Persia and Abyssinia); Anderson's 'The Lion and the Elephant'; Porter's 'Wild Beasts'; the hunting narratives of Gordon Cumming, Gerard, Harris, Holub, Baker and Selous; Lyddeker, 'Game Animals of Africa' (London 1908); Patterson, 'The Man-Eaters of Tsavo' (ib. 1908); Pease, Sir A., 'Book of the Lion' (ib. 1914); Roosevelt and Heller, 'Life History of African Game Animals' (New York 1914).

LION IN ART. With the ancient Egyptians the lion was dedicated to the god Shu and the goddess Sechmet, both of which were, therefore, represented with the heads of lions. Again, the kingly dignity was represented by a lion's body, its head being given the features of the ruler. As the Nile inundations occurred when the sun was in the zodiacal constellation *Leo,* the lion was symbol of water; hence that animal is found in the decorations of pitchers, pails and other water containers. Cybele (Rhea) with the Assyrians and Greeks was depicted riding on or standing by a lion because that animal was dedicated to her. The lion was also symbol of the all-penetrating, vitalizing and mastering power of fire. The Assyrians and Greeks, in their architecture, made the lion guardian over the palace. To the Greeks and Romans this animal became guardian over springs, doorways, stairways, etc. Dedicated to springs (as *Krenophylax*) the flowing water gushed out of a lion's mouth; again, in Doric architecture we find an open-mouthed lion's head decorating the outlets that released the rainwater from the roof. The lion was the Mithraic symbol of the sun. In Christian art the lion is symbol of Christ as the «Lion of Judah,» and sometimes bears the cruciform nimbus. This animal is the attribute of Saint Jerome and of Saint Mark the Evangelist as well as of the Prophet Daniel. The lion and serpents are ecclesiastical symbols of «the World and the Devil» (seeking whom he may devour). In the decorative arts the lion, typical of strength, was used by the ancient Greeks and Romans as a form for supports (legs, etc.) for chairs, benches and tables. The lion's head, with a ring in its mouth, was a favored motif of the Middle Ages and Renaissance as a hitching grip and as doorknocker, and the head alone was used as a knob or rosette decoration. The lion's claw as a motif for the feet of furniture also comes down to us from ancient times. The lion, being considered as the «king of beasts,» has been made symbol of heroism, hence the title of England's King Richard I as *Cœur de Lion* («lion hearted»), etc. In this human significance the artist gives the lion an oval eye instead of the naturalistic round cat's eye. The heraldic lion *couchant* represents sovereignty; *rampant,* magnanimity; *passant,* resolution; *guardant,* prudence; *salient,* counsel, and *reguardant,* circumspection. The sleeping lion has long been the artist's symbol of the fallen hero. The lion statue of Venice, world renowned, in the Piazza San Marco, refers, of course, to that saint. Florence has its heraldic representation in a lion, generally called Marzocco. CLEMENT W. COUMBE.

LION OF FLANDERS, The. 'The Lion of Flanders' by Henri Conscience (1812–83), written in the early years of his career (1838), represents on the artistic side the maximum of his achievement. His father was one of that amazing train of French adventurers who seem to have been called forth to follow the fortunes of Napoleon. The sympathy between the disappointed and erratic father, a foiled, soured and misanthropical man of action, and the patient, earnest and artistically endowed son could never have been close. The future author had been born at Antwerp in the years that marked the decline of Napoleon's power, and his mother was Flemish. His temperament bound him much more to her and to his native land of Flanders which in spite of a glorious past had no status as a nation. The speech of the Flemings was looked upon, even by the Flemings themselves, not as a language, but as a dialect, unsuited to any serious literary effort. With this estimate, Conscience, fond of his mother tongue, could not agree, and he decided to work toward the recognition of Flemish as a language and toward the creation of a Flemish literature. In a long life of patient, conscientious effort, he fully achieved his purpose and is properly regarded as the founder of the Flemish literary movement.

It was natural that with this aim he should have turned for some of his material to the earlier history of his country, the days of the glory of Bruges and Ghent, of the struggles of the guilds and of the old Flemish knights. This provides the background for the moving story of the Lion of Flanders (Robert of Bethune), who made common cause with the Flemish burghers against the French tyranny of Phillip the Fair. It is full of the pageantry of a rich epoch, and moves rapidly with a large, full sweep and swing. The more important male characters are powerfully drawn, though the heroine is weak and unconvincing. Though the 'Lion of Flanders' is substantially accurate, as a picture of the time, it should nevertheless be remembered that the events are marshaled and colored by the author's patriotic fervor and not drawn with the dispassionate analysis of the modern historian. As an historical novel, however, it stands with the best of its class and deserves the celebrity which has brought about its translation into nearly all European languages.

Christian Gauss.

LIPARI, lē'pä-rē, or **ÆOLIAN ISLANDS,** a group of volcanic islands in the Mediterranean, about 24 miles from the north coast of Sicily, situated between lat. 38° 20' and 38° 55' N.; long. 14° 15' and 15° 15' E.; and comprised in the province of Messina. Total area, about 45 square miles. Pop. about 20,000. These islands called by the ancients Æoliæ, Vulcaniæ and Insulæ Liparæorum, were supposed to be the residence of Æolus and Vulcan. Lipari, the largest, is populous and well cultivated, producing great quantities of corn and fruit, especially figs, grapes and raisins; it likewise produces alum, sulphur, nitre and cinnabar. It is about 15 miles in circumference; the air is healthful, the inhabitants industrious and the males good sailors. On the eastern coast is situated a town of the same name (pop. of commune 15,616), containing a castle built by Charles V, a cathedral, a college, several convents and a hospital. A considerable trade is carried on in the principal produce of the island. The other islands are Stromboli, the scene of volcanic eruptions in 1902 and 1907; Panaria, Vulcano, Salina, Alicuri and Filicuri, with a number of smaller ones. The peaks in the islands range from 1,000 to 3,140 feet, the highest, in Salina. Lipari is composed of pumice-stone, lava, volcanic glass and black sand; and the warm baths and heated vapors of the stoves (excavations which emit hot sulphurous exhalations) prove the activity of the subterranean fires.

LIPPI, Filippino, fē-lē-pē'nō, Italian painter, son of the preceding by Lucrezia Buti: b. Prato, 1459; d. Florence, 5 April 1504. He was a pupil of Fra Diamante, but seems to have closely followed the artistic example of his father and Sandro Botticelli. He gained considerable reputation before he was out of his teens. Among his wall paintings, which show a wonderful advance beyond his predecessors, are those in the chapel of the Brancacci family at Florence, in which is portrayed the history of Saints Peter and Paul, and the decoration of the walls of the church of Santa Maria Sopra Minerva, at Rome (1488–93) illustrating the life of Saint Thomas Aquinas. His masterpieces, however, are to be found at Florence — in the Strozzi chapel of Santa Maria Novella, where his frescoes portray the legendary life of the Apostles Philip and John (1502); and in the Badia, which has his 'Vision of Saint Bernard,' regarded as the most perfect expression of his genius. Some of his canvases are in the galleries of Florence, Bologna, Berlin, Munich, Copenhagen; and the National Gallery, London, which has the 'Virgin and Child, with Saint Jerome and Saint Dominic.' Mrs. P. Warren, Boston, Mass., has a representation of the 'Holy Family with Saint Margaret.'

LIPPI, Fra Filippo del Carmine, frä fē-lēp'pō dĕl kär-mē'nä lēp'pē, Italian painter: b. Florence, 1406; d. Spoleto, 9 Oct. 1469. In his 15th year he entered the Carmelite monastery at Florence and became a professed monk in 1421, to which calling he had no vocation. Early formed his style on the example of Masaccio, but was later influenced by Masolino, and Angelico of Fiesole (Fra Giovanni). In 1431 he left his convent, but without release from his vows. In 1434 he was commissioned to paint the 'Coronation of Our Lady' for the high altar of Saint Ambrogio. In 1442 he was appointed by the Pope, rector of the parish of San Quirico, at Legnaia, near Florence. In 1452 he began his work at Prato, and three years after, being convicted of fraud, was deprived of his benefice. He was appointed in 1456 chaplain to the nuns of Santa Margherita at Prato; was commissioned by them to paint a panel for the high altar of their church, and falling in love with Lucrezia Buti, who served as model for his Madonna, he abducted her (1 May) and carried her off to his house. She bore him two children, Filippino Lippi (q.v.) and a daughter, Alessandro. In 1461 he was released from his vows and granted a dispensation to marry her, but the marriage did not take place.

In his best work he united with the spiritual feeling of Fra Angelico of Fiesole the strong historic imagination, energetic modeling and unconventional loveliness of form and face, characteristic of Masaccio. His greatest masterpiece is in the parish church at Prato, and consists of a series of frescoes illustrating the life of Saint Stephen, John the Baptist, etc. Many of his altar-pieces are now in the Florentine Academy. His last frescoes in the cathedral at Spoleto were executed with the collaboration of Fra Diamante. Examples of this painter are also to be found in the galleries of Berlin, Munich, Rome and the National Gallery, London. His 'Saint Lawrence, with Saint Cosmas and Damian and Two Donors' are in the Metropolitan Museum, New York. Consult Strutt, Edward C., 'Fra Filippo Lippi' (London 1901); and Vasari's 'Lives of the Painters.'

LIPPI, Lorenzo, lō-rĕnd'zō, Italian poet and painter: b. Florence, 1606; d. there, 1664. He wrote a comic epic poem in 12 cantos, 'Il Malmantile vacquisdato' under the anagrammatic pseudonym, «Perloni Zipoli» (publ. 1676). The poem abounds in rare humor and is written in light, swift verse. The language, however, abounds in Florentine provincialities, and is unintelligible without such a commentary as is furnished to the edition of 1688 by P. Munucci. As a painter he was an imitator of Santi di Tito's manner and was reputed the best draftsman of his time. There is a 'Crucifixion' of his in the Uffizi Gallery at Florence; and 'The Triumph of David'; and 'Christ and the Woman of Samaria' are in the Imperial Gallery at Vienna.

LIPPINCOTT, lĭp'ĭn-kŏt, **Horace Mather,** American author on historical subjects: b. Philadelphia, 20 April 1877. He was educated at Germantown Academy and the University of Pennsylvania. He is a member of the Society of Friends, a Quaker organization, and is the author of 'The Mather Family of Cheltenham, Pennsylvania' (1910); 'The Colonial

Homes of Philadelphia and Its Neighborhood› (1912); ‹A Portraiture of the People called Quakers› (1915); ‹Early Philadelphia› (1917). He is also editor of *The Alumni Register*, the graduate monthly magazine of the University of Pennsylvania.

LIPPINCOTT, Joshua Ballinger, American publisher: b. Juliustown, N. J., 1816; d. Philadelphia, 5 Jan. 1886. He was a bookseller in Philadelphia 1831–36 and in the last named year founded the house of J. B. Lippincott and Company. In 1850 he bought the business of Grigg and Elliott, and his firm then assumed the leading position in the publishing business in Philadelphia. After his death, in 1886, the firm was converted into the J. B. Lippincott Company. *Lippincott's Magazine* was established in 1868. Upon the death of J. B. Lippincott, his son Craige (1846–1911) became head of the firm. The latter was born in Philadelphia, educated at the University of Pennsylvania and in Europe, and entered the publishing business in 1866. On his death in 1911 he was succeeded by his brother, Joshua Bertram, b. Huntington Valley, Pa., 1857.

LIPPINCOTT, William Henry, American artist: b. Philadelphia, Pa., 6 Dec. 1849. He began his art studies in the Pennsylvania Academy of Fine Arts, and his first professional appearance was as a book illustrator and later as a scene painter. In 1874 he became the pupil of Bonnat and for the eight years he remained at Paris exhibited annually in the Salon. The wide range of the work which he has done since he took up his residence in New York includes portrait, genre, landscape and scene painting, and he appears regularly as an exhibitor in the annual American art exhibitions. His most important pictures include ‹The Duck's Breakfast›; ‹Un Jour de Congé›; ‹Pink of Old Fashion›; ‹Helena›; ‹Infantry in Arms›; ‹Love's Ambush›; and ‹Pleasant Reflections›; ‹The Crucial Moment›; ‹Daily Duties›; ‹Shore Duty); ‹Love Finds the Way›; ‹Rock Bound Maine Coast,› etc.

LIPTON, Sir Thomas Johnstone, Irish merchant and yachtsman: b. Glasgow, Scotland, 1850. He came to America as a steerage passenger in 1865, for two years worked in the South Carolina rice fields, later in various Northern towns, opened a provision shop in Glasgow, attained great business success and finally organized «Lipton, Limited,» the largest commercial establishment in the United Kingdom, where it controls 420 shops. This business is capitalized at $200,000,000, with tea, coffee and cocoa estates in India and Ceylon, fruit-orchards in Kent and elsewhere, and a packing-house and refrigerator-car line in Chicago. Lipton has given largely for charitable purposes. He is best known, however, for his attempts as a representative of the Royal Ulster Yacht Club to win the America Cup in the international yacht-races of 1899, 1901 and 1903. His three British-built yachts were in each contest defeated in three straight races. He was knighted in 1898 and made a baronet in 1902. During the earlier stages of the European War he used his steam yacht to carry relief to the stricken inhabitants of Serbia.

LIQUEFACTION OF GASES. See Liquefied and Compressed Gases.

LIQUEFIED AND COMPRESSED GASES. Introductory Statement.— Matter, that is all physical substance, commonly is understood to exist in three forms, solid, liquid and gaseous. Under ordinary conditions this is a true concept but it is not generally appreciated that in reality matter may be changed from one form to another, that a solid under one condition of temperature and pressure becomes a liquid at another, and a gas at a third. Conversely a gas by similar changes in temperature and pressure may be converted into a liquid or a solid. The earth typifies all matter, its crust being composed of solids, its oceans, lakes, rivers and in part its molten interior liquids, and its atmosphere and the vapors pent up within its interior, gases. The genius of mankind in the past has been directed to utilizing for man's comfort and convenience mainly solids and liquids. Only in comparatively recent times, however, has attention been seriously directed to the utilization of gases and to applying commercially the principle that solids and liquids may be reduced to gaseous forms, and so reduced find many fields of employment in the arts and sciences. It was as late as 1827 that the first commercial employment of gas was made in this country in which year illuminating gas was introduced in New York City. The next commercial use was in 1870 when carbonic acid gas was developed industrially. It is employed largely in carbonated beverages, fire extinguishers. insecticides and many other products.

In 1863 nitrous oxide was applied in dental operations for the purpose of permitting work without pain.

In 1875 oxygen was developed for medical purposes in diseases of the lungs. About the same time oxygen was employed in connection with calcium light for spotlights and scenic effects.

In 1895 acetylene was introduced commercially to illuminate country homes and in bicycle headlights. About the same time anhydrous ammonia began to be used for refrigerating purposes.

In 1907 the manufacture of oxygen on a commercial scale for industrial purposes was commenced in this country by the liquid air process; and in connection with the industrial application of this gas, acetylene was used in welding and cutting steel with the oxy-acteylene blowpipe or torch.

Since 1907 many new gases, the existence of which in quantities in the earth or in substances known on the earth was unsuspected, have been discovered and put to commercial use. For example, it was supposed until recent years that the air which we breath was composed of four parts of nitrogen and one part of oxygen. It is now known that in addition to these two gases which make up the major portion of our atmosphere, there are eight other gases contained in minute quantities in it, among them, argon, neon and krypton. Of these gases, argon and neon have been found to have a commercial value, the former in the manufacture of incandescent lamps and the latter for lighting purposes. In like manner, helium, a gas which was known to exist in the sun but which was supposed to be a rare element on the earth, is now known to exist in many substances and since the declaration by the United

States of a state of war with Germany, methods have been found for extracting this gas in large quantities from various substances at comparatively small cost. This gas is now being employed extensively for military ballooning, because it is not inflammable.

Within the last decade the discovery of new gases and the development of new uses for the known gases has brought into being a new industry which in the same period has grown with rapid strides until it has become an industry vital to the commercial life of the country and one which played an important part in the World War. As an example of this unprecedented development, a single branch of that industry, namely, the oxygen business, may be taken. In 1907 there existed in this country a single plant which had been built in that year and which produced annually 24,000,000 cubic feet of oxygen. At the date of this article, some 12 years later, the yearly production of oxygen is estimated at over a billion cubic feet and the oxygen plants scattered throughout the entire expanse of the United States number over 200. The commercial utilization of the other liquefied or compressed gases has paralleled that of oxygen and to-day the United States is dotted with plants manufacturing commercial gases representing an investment of well over $100,000,000 and an annual production of billions of cubic feet of gas. Despite all this the present stage of development represents the merest scratch of the surface of an immense field yet untouched which lies beneath for exploitation.

As the industry has grown and the use of various gases has developed, the transportation of these gases has become an important factor. When gases first were employed commercially they were transported in large metal containers under relatively small pressure. As the demand for gas increased, however, it was found that the old type of container did not permit of transportation in sufficient quantities because of the limitations placed upon the size of containers by the necessity of convenient handling. To overcome these difficulties the containers were made stronger and smaller and the quantity of gas in an individual container, or cylinder as it is termed in trade circles, was increased by subjecting the gas to a great increase of pressure. In this connection one must understand that as the pressure on the gas increases its volume decreases in certain proportions which vary with different gases. By increasing the pressure on the gas to a certain point and at the same time reducing the temperature the gas may be changed to liquid form and many gases are shipped in the form of liquids but on being released from the presure in the container they again assume the gaseous form desirable for utilization. It is because of this fact that these gases are termed commercially liquefied or compressed gases as distinguished from other gases like illuminating gas which are employed generally at approximately atmospheric pressure.

With the change in the character of containers there grew up the hazard from breakage of a container and the sudden expansion of the compressed gas by its release from pressure. In consequence the Federal and State authorities found it necessary for the safety of the public to devise rules and regulations governing the character of containers which would be permitted for certain gases and rules for their handling while in transit. This necessity has resulted in legislation governing the transportation, storage and employment of gases under pressure. The chief agency having charge of these matters and the one which has shaped in large measure the legislation in this field is the Bureau of Explosives.

With the development of the industry there came also the need for co-ordination between manufacturers of compressed and liquefied gases and of equipment used in connection therewith. In consequence there have been organized several trade organizations having for their object the promotion of uniform and proper legislation governing compressed and liquefied gases, as well as the commercial application of the gases generally. In most works of reference the treatises on gases have been separate, arranged alphabetically in different parts of the work. However, it has been deemed advisable in this article to deal under one title with all gases which in a compressed or liquefied state have a commercial use because this industry represents to-day a separate and distinct field, and because there is much about the employment, transportation and use of every compressed gas which is common to all. The foregoing short history of the commercial use of gases is followed immediately by separate treatises, alphabetically arranged, which deal at length with all the more important liquefied or compressed gases.

ACETYLENE.* **Chemical Properties.** C_2H_2— carbon 92.25 per cent, hydrogen 7.75 by weight. At atmospheric pressure and 60° F., the volume of one pound of acetylene is 14.53 cubic feet. Acetylene requires 11.92 volumes of air or 2.5 volumes of oxygen for its complete combustion. Acetylene is a colorless, tasteless gas; when chemically pure it has a sweet ethereal odor; when in commercial form traces of impurities impart to it a pungent odor suggesting garlic. Acetylene is an unsaturated hydro-carbon. It exists in a state of unstable chemical equilibrium and owing to this fact it combines very energetically, having low ignition temperatures, namely, 804° F. in air and 782° F. in oxygen, compared with about 1200° for other gases under similar conditions.

When mixed with the proper proportions of air and ignited, acetylene will give rise to a so-called gas explosion, as will any other combustible gas or combustible solid if in a state of sufficiently minute subdivision. The explosive range for acetylene under ordinary conditions is from 3 per cent of acetylene and 97 per cent of air to 24 per cent of acetylene and 76 per cent of air, the point of maximum explosibility being 12 per cent of acetylene and 88 per cent of air. Unlike other gases, however, acetylene possesses high endothermic energy, greater than that of any other ordinary substance. By this it is meant that the elements forming actylene may be considered as being in a state of chemical stress and capable of giving rise to a very considerable amount of heat by the mere act of their separation. In other words, an endothermic substance will give more heat when burned as a compound than can be obtained from burning its separate elements in the uncombined state. The carbon and hydrogen forming one cubic foot of acetylene would produce 1,248 heat units if they were burned separately. One cubic foot of acetylene, however, formed from the same carbon and hydrogen will produce 227 heat units more than this amount, making a total of 1,475 per cubic foot. The 227 heat units represent endothermic energy. Owing to this endothermic energy, acetylene acquires true explosible properties and will dissociate with explosive violence without admixture of air or oxygen if it is compressed slightly in excess of 20 pounds per square inch and ignited. Owing to this property, insurance, police, transportation and fire authorities prohibit the manufacture, storage and transportation of acetylene at a pressure exceeding 15 pounds per square inch, except when the acetylene is compressed into cylinders containing a porous substance having a degree of porosity which will prevent the propagation of an explosion.

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*All temperatures in degrees Fahrenheit; all pressures in pounds avoirdupois.

Acetylene, at atmospheric pressure, is soluble to the extent of about volume for volume in water. It is also soluble in varying proportions in alcohol, chloroform, benzene, paraffin, olive oil, ether, carbon-bisulphide, etc. It is soluble to a remarkable extent in acetone, which liquid will dissolve 25 times its own volume of acetylene at atmospheric pressure and an additional 25 volumes for each atmosphere of pressure to which the acetylene may be subjected. Commercial advantage is taken of this property and acetylene under pressure is now stored and transported in cylinders which are packed with a porous substance soaked with acetone. The porous mass employed in such cylinders generally consists of asbestos in the form of blocks built up and reinforced with silicate of soda, or of a mixture of charcoal, kieselguhr and cement, molded into the cylinders. Cylinders containing acetylene compressed into a porous substance of a proper degree of porosity, or compressed into a porous substance soaked with acetone, or other suitable solvent, are safe and their use is permitted. Acetylene stored in this way is commonly known as dissolved acetylene. The use of acetylene dissolved in acetone gives to this gas a portability and a universality not possessed by any other lighting or heating agent. Cylinders of acetylene are now carried on motor cycles, trucks and small boats, and they are obtainable at country stores as well as in the cities. This has resulted in the education of thousands of people in the use of gas who used to depend upon the liquid fuels for their light and heat.

Acetylene has no toxic properties and may be taken into either the lungs or stomach with impunity, even when mixed in air in considerable proportions. Acetylene is a true gas, that is, it consists of only one chemical compound and is not a mixture of a number of gases each with its own peculiar characteristics, as is the case with most other illuminating and fuel gases. Under pressure, acetylene obeys Boyle's Law for the compression of gases and its Pressure-Volume Curve is practically straight up to the liquefaction point, which at ordinary temperatures is 700 pounds per square inch. Owing, however, to the dangers in *unabsorbed* compressed acetylene this gas is never subjected to pressures anywhere approaching its liquefaction point. Acetylene may be mixed with most ordinary gases with impunity, but if mixed with chlorine and subjected to sunlight, it will combine with considerable violence. Acetylene may be used as an enricher of other gases to increase their candle powers and calorific values. It is employed for this purpose in European countries in the Pintsch gas used for train lighting. When added to an illuminating gas, acetylene will increase the heating value in direct proportion to its presence in the mixture and the illuminating value by about two candle power for each per cent of acetylene added. It cannot compete however in point of price with oil and other enrichers and for this reason is not ordinarily used for this purpose.

As stated above, acetylene obeys Boyle's Law for the behavior of true gases under variations of volume and pressure. It also obeys Charles' Law, governing the relation of temperature to volume. However, if acetylene is subjected to a temperature in excess of 538° F., changes of great chemical complexity take place in its structure. For this reason, care must be taken not to overheat this gas in its generation or in the appliances in which it is used. Under the influence of heat acetylene will break up or rather double up — polymerize — into a vast number of hydro-carbons, ranging from benzene (C_6H_6) to heavy black tars according to the degree of temperature. If once heated to the point where polymerization occurs, no amount of subsequent cooling or purification will restore the acetylene.

Acetylene has a density of 0.92, air being 1. Its atomic weight is 26. Its critical temperature is 99° F., which means that the curve of power for compression reaches a straight line at this temperature and hence no amount of pressure will serve to liquefy, if in excess of this temperature. The critical pressure of acetylene is 995 pounds per square inch.

Domestic and Commercial Uses.— Acetylene is used for isolated lighting plants throughout the country; homesteads, farms, churches, lodges and similar institutions are illuminated with acetylene from generators devised for the purpose. Owing to its relatively higher cost, acetylene does not compete in its present stage of development with electric or illuminating gas for city lighting. It is used quite extensively for cooking purposes in connection with isolated lighting plants. Dissolved acetylene is used for buoy lighting and for other aids to navigation. Buoys carrying sufficient gas to supply their lights continuously for 15 months are in use practically all over the world. These are veritable self-attending light ships. A large number of them are provided with «sun valves» which are actuated by the direct heat of sunlight, turning off the acetylene when the sun shines and turning it on again when darkness, fog or clouds intervene. There are some 360 acetylene buoys marking the channel of the Panama Canal. Owing to its low ignition temperature, acetylene cannot be compressed in an engine cylinder to a sufficiently high point to render the engine efficient; hence acetylene has never developed into a power proposition.

Acetylene is used in small portable lamps for mining purposes, the present acetylene miner's lamp being practically the first improvement in mine illumination for 200 years. Practically all the metal mines in the United States and its dependencies, as well as the coal mines which are not gaseous, are now lighted with acetylene. The acetylene cap lamp has about 18 candle power, head on, as compared with three-fourths candle power given by the old form of oil lamp, and its light can be directed to any spot desired by means of the reflector which is an integral part of the lamp. Acetylene is used to a very large and increasing extent for welding and cutting purposes, because of certain physical peculiarities now to be discussed. The theoretical temperature of any flame may be calculated from the amount of heat generated by the combustion of the fuel and the amount of heat absorbed by the products of the combination. Water vapor will absorb four times more heat for a given increase in temperature than carbon dioxide and those fuels which burn to carbon dioxide have a higher flame temperature than those which burn to water vapor. The flame temperature of any hydro-carbon varies in proportion to the relative amounts of carbon and hydrogen of which it is composed. Acetylene has more carbon and less hydrogen than any other known substance, with the exception of the solid naphthalene which is devoid of the endothermic energy mentioned. This being the case, its products of combustion have a maximum of carbon dioxide and a minimum of water vapor. Added to this is the fact that acetylene possesses a very high endothermic heat content which gives off heat without producing any additional products of combustion. When the volume of the combustion products is reduced by the removal of the nitrogen from the air and when pure oxygen is used, the combustion of acetylene results in a higher flame temperature than that of any other substance known or recognized as possible in chemistry. The combustion of acetylene with oxygen produces the acme of flame temperature — 7878° F. being the theoretical maximum. Owing to radiation and convection losses, the actual available flame temperature is in the neighborhood of 6300° F. This gives to a blow pipe consuming acetylene and oxygen the power to produce, in portable form and small compass, a temperature approaching nearly that of the electric arc. This has resulted in the wide employment of acetylene in conjunction with oxygen for the welding and cutting of metals. The oxygen cutting blow pipe, in which acetylene is commonly employed as the fuel gas, is used extensively for cutting steel bars, plates and ingots to shapes and lengths, and in wrecking work. The oxy-acetylene cutting torch was employed in cutting up the *Maine* in Havana Harbor, and for cutting out the Quebec Bridge. The cutting process has proven invaluable in fire fighting and in marine, mine and railroad rescue work, notable examples being the Equitable Building fire in New York and the *Eastland* disaster in Chicago. The process is used extensively in scrap yards and for all classes of demolition work. It is successfully employed for cutting steamships into sections where necessary, as in the case where a ship has to be transported through a lock which is too small to handle it. The oxygen-acetylene cutter has revolutionized wrecking and scrap yard practice in the past few years and the acetylene welding torch has produced great changes in the methods of metal construction during the same time. If a cutting blow pipe is provided with a sheath of compressed air to force water away from its nozzle, cutting can be performed under water. It is said that the Germans used the process of cutting under water for freeing their submarines from submarine nets. The under-water cutting blow pipe is commonly employed for cutting metal sheet piling under water. Acetylene is used to a limited extent as a basis in the formation of chemical substances. This use, although it possesses considerable promise, is in the laboratory rather than in the commercial stage at this writing.

History.—As a theoretical possibility and laboratory curiosity acetylene has been known for many years. It exists in illuminating gas in fractional percentage and was produced as early as 1876 by scrubbing coal gas with a copper solution. It was prepared on a laboratory scale by Berthelot and Wohler many years ago. Its birth, however, as a commercial possibilty occurred 4 May 1892, when calcium carbide was produced in an electric furnace located at Spray, N. C., by the Willson Aluminum Company. This company was experimenting with a view to improving its process for the production of aluminum and was endeavoring to produce metallic calcium to be used as a reducing agent for aluminum oxide. To this end a mixture of calcium oxide (quick lime) and coal tar was fused in an electric furnace in the hope that the carbon would act as a reducting agent, removing the oxygen from the lime, and leaving the calcium free, the metallic calcium to be used in a subsequent step in the process of producing metallic aluminum. The reaction removed the oxygen from the lime, as was expected, but left the calcium in combination with a portion of the carbon instead of in a free state, and this combination was found to be calcium carbide. The development of the production of calcium carbide has progressed steadily from that date until the present time, most of the development being under the supervision of two of the men who were operating the original furnace and who are still prominently identified with the industry. There have been revolutionary changes in the process of manufacturing carbide, especially in the size and extent of the operation. The main underlying process, however, of subjecting lime and carbon to the intense heat, obtainable only in the crater of an electric arc, has not changed from 1892 to date. Carbide was introduced into Europe shortly after its discovery. European production has developed to a very large extent. The present advancement in the process is, however, practically all due to American efforts; the foreign manufacturers have followed American practice without substantial contribution to its progress. The temperature necessary to form calcium carbide is so intense that the process does not lend itself to laboratory methods and as far as is known it has never been produced on a small scale.

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AMMONIA, Anhydrous (NH_3).— Priestley, in 1774, was the first to isolate ammonia, having collected it over mercury. Scheele, in the same year, discovered that it contained nitrogen. Its true composition was determined by Berthollet in 1785. Liquid ammonia, however, was first obtained by Faraday, in 1823, by warming the compound $2AgCl3NH_3$ in a sealed tube.

Physical Properties.—

Colorless, with pungent odor, strongly alkaline taste, and has alkali reactions.

Molecular weight, 17.03.

Specific gravity, calculated, 0.5883; specific gravity, observed, 0.5962; specific gravity of liquid, 0.6234.

Melting point, —77.34° C.

Boiling point, —38.5° C.

Critical temperature, —130° C. (Dewar); critical pressure, 115 atmospheres (Dewar).

Coefficient of expansion at constant pressure, 0—100° C., 760 mm., .003800; at 0° C., 760 mm., .00386; coefficient of pressure at constant volume, 0° C., 760 mm., .003800; at 0—100° C., 760 mm., .003770.

Specific heat, 0.5009 at 0° C.; 0.5317 at 100° C.; 0.5629 at 200° C.; 0.5202 between 23—100° C.

Heat of formation of gas, 11,887 calories; in solution, 20,322 calories.

Heat of formation of gas, at 15° C., 12,200, and of liquid 16,600 (Chem. Kalendar).

Heat of absorption in water, 8,435 calories.

Weight of one liter, calculated, 0.7606 grams; observed, 0.7708 grams; weight of one cubic foot at 32° F., 29.92" pressure, .04812 lbs.

Solubility in water (Roscoe and Dittmar). Grams of ammonia in one gram of water. At 0° C., 0.875; 10° C., 0.679; 20° C., 0.526; 30° C., 0.403; 40° C., 0.307; 50° C., 0.229.

Latent heat of evaporation, being higher than that of any other known liquid except water, is 5,000 cal. at 15° C. and 5,600 cal. at boiling point. Hence the use of ammonia for refrigeration.

Chemical Properties.— Ammonia is poisonous and attacks the mucous membrane. Serious effects on human beings are experienced when the atmosphere in which they are has a greater quantity of ammonia than five one-hundredths of 1 per cent. Ammonia will not burn in air at ordinary temperature, but will do so when heated, and burns still more readily when mixed with oxygen. With the aid of catalysts (copper, iron, nickel, and especially platinum), ammonia is oxidized by oxygen or air at low temperatures. At atmospheric pressure ammonia begins to decompose below 500° C., the rapidity of decomposition varying with the nature of the surfaces with which it is in contact, glass being inactive but porcelain and many metals and oxides accelerating, decomposition being nearly complete when the latter are present. Ammonia is very soluble in water, alcohol, ether and many saline solutions. The aqueous solution of ammonia is strongly alkaline and unites with acids to form salts.

How Obtained.— Ammonia occurs mostly in combination with acids, but is found in a free state in fumaroles of Monti Carboli in Tuscany, which also contain ammonium sulphate and borate. It is present in the air to the extent of one hundred parts of ammonia to one million parts of air. For laboratory purposes it can be obtained by the action of calcium oxide on ammonium chloride. A mixture of hydrogen and any oxide of nitrogen, passed over a heated porous body, such as spongy platinum, pumice, or ferric oxide, produces ammonia. It may also be produced by passing moist nitric oxide over hot iron filings; and also by heating solutions of nitrates or nitrites with caustic alkali and zinc.

Laboratory Methods of Preparation.—(1) By gently warming the aqueous solution of ammonia and passing the gas over quicklime. (2) From lime and an ammonia salt (e.g., chloride or sulphate) by heating together in a retort.

Ammonia is a decomposition product of the decay or destructive distillation of nitrogenous organic matter.

Commercial Methods of Preparation.— I. DESTRUCTIVE DISTILLATION PROCESSES. 1. *By-product in Manufacture of Illuminating Gas.*— When coal is destructively distilled as in the production of coal gas for illuminating purposes, a number of extremely valuable by-products are obtained such as benzol, toluol, ammonia, phenol, tar, coke, etc. Until some years ago the greatest part of the ammonia production of the world was obtained from the ammoniacal liquors of gas works. These liquors are distilled with excess of slaked lime with the aid of steam (in coils) in stills provided with rectifying columns for concentrating the ammonia gas. The latter is scrubbed by passing successively through towers containing caustic soda solution and paraffin oil, and is thus freed from impurities, such as H_2S, CO_2 and pyridine basis. The purified ammonia gas is then converted to ammonium sulphate, or to aqua ammonia by absorption in distilled water. A small amount of ammonia is made from the materials used in purifying illuminating gas (freeing the latter from H_2S and cyanogen compounds). The purifying material, "spent oxide" or "sludge" (Bueb or Feldmann process) contains a large percentage of combined ammonia which is recovered by gas works or manufacturers who purchase this material from gas plants.

2. *By-product in Manufacture of Coke for Metallurgical Use.*— Until recently, most of the coke required for metallurgical purposes (especially in the manufacture of iron and steel) was made by the distillation of coal in bee-hive ovens in which all the valuable volatile ingredients of the coal were lost. Now, however, particularly since the great demand for coal tar products of all kinds caused by the World War, an increasingly large percentage of coke is being made in by-product coke ovens in which the gaseous and liquid distillates from the coal are recovered and used or sold.

Similarly in some countries (e.g., Scotland) in which blast furnaces have been operated with coal instead of coke the recovery of the volatile ingredients of the coal has met with commercial success.

3. *By-product in the Distillation of the Bituminous Shale.*—In Scotland where this industry has had a large development, and to some extent in this country, the recovery of ammonia has been successfully carried out. About 42 pounds of ammonium sulphate are recovered from one ton of Scotch shale.

4. *By-product in the Manufacture of Glue.*—After glue has been extracted from animal substances, like bones, cartilages, hoofs and horns the residue is destructivcly distilled, yielding among other products ammonia as a valuable by-product.

II. SYNTHETIC PROCESSES.—The world's requirements for nitrogen compounds in the last few years, 1914 to 1918, were so great that the destructive distillation processes were insufficient to meet the demand. As a result, several processes for the fixation of atmospheric nitrogen developed in the last two decades have been successfully applied on a commercial scale. This has been particularly the case in Germany which could not have lasted for more than a year at war without the cyanamid and Haber processes.

1. *The Haber Process.*—In this process, nitrogen and hydrogen are directly combined to form ammonia. The mixed gases are passed at high pressures, 200 atmospheres or more, and at temperatures of 500 to 700 degrees C over a catalyst, such as osmium, uranium or palladium, when combination occurs resulting in the formation of ammonia to the extent of 3 to 12 per cent of the mixed gases. The ammonia formed is then separated by cooling and the remaining gases, together with fresh nitrogen and hydrogen, pumped over the catalizer again. Heating of the gases is effected electrically, the power consumption for the whole process being one-fourth to one-sixth of that required by the cyanamid process. Since the power consumption is so low the production of synthetic ammonia by the Haber process need not be confined to districts having large amounts of cheap power. It is particularly important in a process depending upon the action of catalysts (which are very sensitive to impurities), that gases of the highest degree of purity be used. Nitrogen of satisfactory quality is obtained by the fractional distillation of liquid air. For the manufacture of hydrogen the electrolytic process produces a gas of higher purity than that obtained by any other commercial process, and is therefore, of great value in this connection (see section on hydrogen and oxygen). In the United States the Haber process has not been a commercial success owing to failure to overcome the engineering difficulties of working with gases of high pressures. In Germany the Haber process, as already mentioned, has been developed much further than in the United States. Consult Haber and Le Rossignol, 'Zeitschrift für Elektrochemie' (1913, 19, 53, 72, abstracted in Journal, Society of Chemical Industry, 1913); 'Bericht' (1907, 40, 2144); 'Zeitschrift für Elektrochemie' (1908, 14, 181, 513); Bernthsen, Eighth International Congress Applied Chemistry 1912 (abstract Journal of the Society of Chemical Industry 1912, 31, 982).

2. *Cyanamid Process.*—Ammonia is produced indirectly in this process by the following reactions:

(a) $CaO + 3C = CaC_2 + CO.$
(b) $CaC_2 + N_2 = CaCN_2 + C.$
(c) $CaCN_2 + 3H_2O = CaCO_3 + 2NH_3.$

(a) Quicklime is mixed with coke and allowed to react at the highest temperature of the electric furnace. The molten calcium carbide thus formed is run off, cooled and ground in ball mills filled with nitrogen gas.

(b) The powdered calcium carbide is next charged into small electric resistance furnaces and a current of pure nitrogen gas passed through. The start of the reaction requires some electrical energy, after which the temperature is maintained by the heat of reaction. Calcium cyanamid is formed.

(c) The calcium cyanamid or "lime nitrogen" is finely powdered and treated in stirred autoclaves with high pressure steam and a dilute solution of caustic soda. The ammonia begins to evolve in large quantities at four to five atmospheres. This process requires a large amount of cheap electrical energy and high initial outlay of capital for equipment.

3. *Serpek Process.*—When bauxite (the mineral hydrated alumina) is heated with coal in an atmosphere of nitrogen at 1,700° to 1,800° C. in an electric furnace, the following reaction takes place:

$$A_12O_3 + 3C + N_2 = 2A_1N + 3CO.$$

Absorption of nitrogen begins at 1,100° C., is rapid at 1,500° C. and extremely rapid at 1,800° C. The reaction is endothermic (213,220 calories being absorbed, according to Richards). The aluminum nitride formed is treated with caustic soda, forming ammonia and sodium aluminate:

$$A_1N + 3NaOH = NH_3 + Na_3A_1O_3.$$

According to German Patent 243,839 (Badische Company), the formation of nitride from alumina and coal is facilitated by the addition of certain catalysts, 5 to 10 per cent of the oxides of Si, Ti, Zr, V, Be, Mo, Ur, Ce, Cr, which are capable of forming stable nitrides. Consult Serpek, British Patent 13,086 (1910); Richards, J. W., Transactions American Electro Chemical Society (1913, 23, 35); Tucker, S. A., Journal Society Chemical Industry (1913, 32, 1143); Fraenkel, 'Zeitschrift für Elektrochemie' (1913, 19, 362).

Preparation of Anhydrous Ammonia.—Aqua ammonia obained by either a destructive distillation or synthetic process is distilled and the ammonia vapors dried by passing over quicklime. The dry gas is then generally compressed and liquefied in steel cylinders, a pressure of 6.5 atmospheres being required at plus 10° C. The purified ammonia formed in the process may also be dried and liquefied directly.

Uses.—The principal use of anhydrous ammonia is for refrigeration, as in the manufacture of artificial ice. When liquefied ammonia is allowed to expand in a suitable machine the fall in temperature is sufficient to freeze water. Consult Lunge, 'Coal Tar and Ammonia'; Vincent, C., 'Ammonia and Its Compounds'; Marten, G. and Barbour, William, 'Industrial Nitrogen Compounds'; 'Synthesis of Ammonia and Oxidation to Nitric Acid' (in *Metallurgy and Chemistry*, 17, 345); Boyce, J. C., 'Bibliography of Production of Synthetic Nitric Acid and Synthetic Ammonia' (in *Metallurgy and Chemistry*, 17, 328); 'Nitrogen Fixation Patents' (*in Metallurgy and Chemistry*, 17 606); Hosmer, 'Literature of the Nitrogen Industry, 1912–1916' (in *Journal Industrial Engineering and Chemistry*, 9, 424).

ARGON, symbol A (or Ar), a gaseous element, was first actually obtained in 1785 by Cavendish who observed that "not more than 1/120th part" of the atmosphere remains after treating the air for removal of oxygen and nitrogen. Attention was not called to this statement by Cavendish until 1894 when Lord Rayleigh found "atmospheric nitrogen" to be ½ per cent heavier than "chemical nitrogen."

For some years previous to this discovery Lord Rayleigh had been engaged in a careful determination of the densities of certain gases and consistent results had been obtained for all of them save nitrogen, which, when prepared from air by the abstraction of all other known components, was found to be heavier by about one part in 200 than the nitrogen prepared from nitrogen compounds such as ammonia, ammonium nitrite, urea, nitric or nitrous oxides. There could be no doubt about the reality of the difference, because the same experimental methods, when applied to other gases, gave results that were consistent with one another to about one part in 10,000. Lord Rayleigh published a letter in *Nature* narrating these facts and calling for suggestions from chemists as to the cause of the consistent difference in density. No ideas of value were elicited. The possibility that the "chemical nitrogen" was contaminated with hydrogen or that the "atmospheric nitrogen" had polymerized into a state analogous to "ozone" was then disproved by the most careful experiments. At this stage in the investigation Professor Ramsay asked permission to co-operate in the work and his services were gladly accepted.

The hypothesis was made that "chemical nitrogen" contains an unknown gas, *lighter* than true nitrogen; or, that "atmospheric nitrogen" contains some similar gas that is *heavier* than true nitrogen. In spite of the many analyses that had been made of the air, it was thought more probable that the unknown gas would be found in "atmospheric" rather than in "chemical" nitrogen.

It was known that at a red heat nitrogen will combine with metallic magnesium, with the formation of magnesium nitride. "Atmospheric" nitrogen, carefully freed from all known impurities, was therefore passed through a long tube of hard glass filled with magnesium shavings and heated in a furnace. The first experiment of this sort was made in May 1894, and gave encouraging results, the "atmospheric" nitrogen showing a slight but unmistakable increase in density. A more elaborate experiment of the same sort followed in which "atmospheric" nitrogen was caused to pass over hot magnesium for more than two weeks. By this means, its density, originally about 14 (that of hydrogen being 1), was increased to 19.09, and the bulk of the gas under examination was diminished until not much more than 1 per cent of it remained. Plainly a great concentration of the unknown gas had been effected. To remove the last traces of true nitrogen, pure oxygen was next added, and the mixture exposed to a rain of electric sparks in the presence of caustic soda. When so treated, the experimental gas contracted, indicating that the nitrogen was being withdrawn in the form of nitrate of sodium. When contraction was no longer noted, the nitrate of sodium and the excess of oxygen were removed and it was found that the remaining gas was about 20 times as heavy as hydrogen.

When subjected to the electric spark and examined by the spectroscope, this residual gas was found to exhibit certain characteristic groups of red and green lines that did not correspond to any element previously known. The experimenters therefore felt reasonably sure that a new element had been discovered and this conclusion has been borne out by all subsequent investigations.

The discovery of this element (to which the name "argon," meaning "inactive," was given) was formally announced to the public in August 1895, and for it Lord Rayleigh and Professor Ramsay were awarded the Hodgkins prize and also the grand prize of the Smithsonian Institution.

Occurrence.— Argon makes up 1.3 per cent by weight of the atmosphere or 0.933 per cent by volume. It has been found in mineral waters, in the volcanic gases of Mount Pelée and also in fire damp and in coal as well as in gases given out on heating numerous minerals.

Preparation.— The various methods for the preparation of argon use air as the raw material:

(1) Sparking air with oxygen, the method originally used by Cavendish in 1785. Knowing that air contained a considerable quantity of nitrogen, Cavendish raised the question whether all of the apparently nitrogenous part of the air "could be reduced to nitrous acid, or whether there was not a part of a different nature from the rest which would refuse to undergo that change." To decide this point he added an excess of oxygen to air and passed electric sparks through the mixture (precisely as Rayleigh and Ramsay did) until no further diminution of volume occurred. He then removed the excess of oxygen, together with the oxide of nitrogen that had been formed, and found that only a small bubble remained unabsorbed, which, he says, was not more than one-120th part of the bulk of the original nitrogen. The bubble that he thus obtained and the nature of which he did not further question must have been nearly pure argon.

(2) Separation from "atmospheric" nitrogen, the nitrogen being absorbed by a metal. Red-hot magnesium shavings were used by Rayleigh and Ramsay, but this material is no longer used, as a mixture of five parts pure lime and three parts of magnesium dust has been found preferable. By passing "atmospheric" nitrogen over this red-hot mixture and the residual gas over metallic calcium at a dull red heat, Maquenne readily effected complete absorption of the nitrogen; metallic lithium has also been utilized for this secondary absorption.

(3) The most convenient laboratory method for preparing argon is to absorb oxygen and

nitrogen from the air by passing it slowly over a mixture of nine parts calcium carbide and one part calcium chloride, heated to 800° C., the remaining gases being led over hot copper oxide to remove the hydrogen, hydrocarbons and carbon monoxide present and finally removing the water vapor and carbon dioxide. It is stated that by using seven kilograms of carbide, 11 litres of argon may be obtained from air in two days.

(4) Argon is more soluble in water than nitrogen; this property is the basis of some recent patents for the separation of argon and nitrogen, but there has been no production by this method to date.

As obtained from the atmosphere argon always contains traces of neon, krypton, xenon and helium. The total quantity of these gases present amounts to only about 0.25 per cent of the argon, 85 per cent of this impurity being neon.

Properties.— Argon is 1,379 times as heavy as air. The critical temperature of argon is —117.4° C. and the critical pressure 52.9 atmospheres. At atmospheric pressure the boiling point of liquid argon is —186.1° C., the freezing point —187.9° C. and the melting point of solid argon —188° C. The density of liquid argon at —186.1° C. is 1.4046.

Since its discovery argon has been treated with the most violent reagents known to chemists, but it refuses to react with any of them. Rayleigh and Ramsay stated that “argon does not combine with oxygen in the presence of alkali under the influence of the electric discharge, nor with hydrogen in the presence of acid or alkali, nor when sparked, nor with phosphorus at a bright red heat nor with sulphur. Tellurium may be distilled in it and also sodium and potassium. Red-hot sodium peroxide has no effect. Persulphides of sodium and calcium have no effect at a red heat. Platinum sponge does not absorb it. Aqua regia, bromine water, bromine and alkali and potassium permanganate are all without influence. Mixtures of metallic sodium and silica or of sodium and boric acid are likewise without influence and hence also nascent silicon and boron.” Moissan found that even fluorine does not act upon argon at any temperature. Villard claims to have formed a crystalline hydrate with water, but this result requires confirmation.

The chemical inertness of argon has made it impossible to study its atomic weight and molecular weight by methods other than the determination of its density which is 19.14 ± (O = 16). On this basis the molecular weight is 39.88. The atomic weight is the same, as has been deduced from a comparison of the specific heats of the gas under constant pressure and at constant volume.

The spectrum of argon is very characteristic. The most permanent lines are two in the red, a yellow line, two green lines and a violet line. It varies slightly depending on the method of preparation, but this is doubtless due to the presence of traces of impurities introduced by the reagents used in removing the large quantities of nitrogen, etc., from the argon.

Manufacture and Uses.— Commercial production of argon in the United States began in the latter part of the year 1914, when it was being manufactured for use as an inert gas in incandescent electric light bulbs. The fact was soon developed that it possessed distinct advantages in connection with incandescent electric lighting, and the demand for this purpose grew rapidly. At the present time commercial production in the United States amounts to thousands of cubic feet of pure argon per month.

The commercial product sold as argon contains 25 to 30 per cent pure argon. This is purified by the consumers to a product containing approximately 80 per cent argon and 20 per cent nitrogen, in which form it is introduced into lamps.

All of the argon used commercially at the present time is made by air liquefaction processes. Both of the commercial air liquefaction processes in use to-day, the Linde and the Claude, are readily adaptable to the production of argon on a commercial scale.

CARBON DIOXIDE. The popular belief that poisoning from carbon dioxide occurs in unventilated and overcrowded rooms is a mistaken one. Results observed on such occasions are due in large part to the reduction in the amount of oxygen present and not to the increase of carbon dioxide, which in no sense is a poison, but which is frequently confounded with carbon monoxide, one of the deadliest of poisons.

Commercial Methods of Manufacture.— Carbon dioxide is extracted from natural sources at many places in Europe and at Saratoga Springs, N. Y. Its origin is debatable but is generally considered to be volcanic and it is obtained by sinking wells from which the gas issues as such, or combined with saline water. A purity of less than 98 per cent is not commercially satisfactory and if a “dry gas” well does not come up to this the desired purity is generally obtained by sinking to greater depths. Failing this the impure gas must be treated by absorption as described under the coke process.

Where the gas occurs, as at Saratoga Springs, saturating the escaping spring water in proportions as high as five volumes of gas to one of water, its recovery is a simple matter. The pipe carrying the saturated spring water delivers its burden to a separator whose trapped water outlet offers greater resistance than the water seal of the storage gasometer, with the result that the water flows away, holding only that amount of gas due to atmospheric pressure and temperature of emergence — about equal volumes of gas and water — and the surplus gas is piped from the top of the separator to the gasometer.

If, as sometimes occurs, hydrogen sulphide is present, its removal is effected before storage of the gas by passing it through trays filled with iron oxide mixed with wood shavings. After saturation the oxide is revivified by exposure to air.

The natural carbon dioxide at Saratoga Springs has a purity of about 98.5 per cent and in common with gas of like origin from several other sources has been found to be radio-active.

A process for manufacture of carbon dioxide which has been largely displaced depends upon the calcination of magnesite (carbonate of magnesia). The rock, crushed to suitable fineness, is fed to oil-fired retorts, and carefully held at the proper temperature. The escaping gas, passed if necessary through purifiers for removal of traces of sulphur compounds, and then through coolers, is conveyed to the gasometer while the calcined magnesia, containing always more or less unburnt magnesite, is allowed to cool, ground and sold as a by-product. Its value is largely affected by the care with which the calcination is conducted and by the presence of calcium salts which are highly deleterious for certain uses. Until the development of the California deposits, the chief source of supply was Grecian. Importations from that source were suspended early in the war.

A small amount of carbon dioxide is produced by plants engaged in the manufacture of epsom salts. The process is purely the laboratory one on a large scale, of adding an acid, sulphuric, to a carbonate, magnesite. There is, however, a variation, wherein dolomite, a mixed carbonate of magnesia and lime, is treated with sulphuric acid and the resulting mixed sulphates separated. In both cases the carbon dioxide obtained is of high purity and passes to the gasometer without further treatment. The normal demand for epsom salts is not such as to stimulate production along these lines.

A small amount of carbon dioxide has been produced in the manufacture of beer, but the advent of prohibition has closed this avenue. Such great difficulties were found in removal of odorous products of fermentation that gas from this source never became a product of importance.

The coke process is the one most generally used in the commercial production of carbon dioxide. Substantially it involves the combustion of coke with effort to secure as high a percentage of carbon dioxide as possible in the resulting gaseous products. These are passed through scrubbers and thoroughly washed to ensure removal of any sulphur compounds, and then enter the absorbing towers. These are generally of steel, about eight feet in diameter and 50 feet high and of any desired number, depending on the capacity of the plant. In general about 10 cubic feet tower capacity per pound carbon dioxide per hour is accepted as a suitable distributing proportion. The gases are there brought in contact with a solution of carbonate of soda or potash which is pumped to the top and flows counter-current against the gases.

The carbon dioxide of the mixed gases of combustion unites with the carbonate and forms bicarbonate, though the interchange is far from complete. Some of the carbon dioxide escapes unabsorbed and some of the carbonate is unconverted to bicarbonate.

The solution issuing from the towers, containing bicarbonate, is now pumped through suitable heat exchangers to the lye boiler. This may either be heated by the coke fire which served to produce the gases or by exhaust steam from the engine and compressor. In the latter case the coke is burned under the steam boiler.

By boiling the bicarbonate solution, it is reconverted to carbonate and the released carbon dioxide is piped through heat exchangers and coolers to the gasometer.

Final preparation for the market consists in liquefying the gas in compressors operating in either three or four stages at about 900 pounds per square inch and storing it in steel cylinders holding either 20 or 50 pounds of the gas.

Commercial Uses of Carbon Dioxide.— The larger portion of commercial carbon dioxide is used in the manufacture of carbonated beverages. It is also used in refrigerating machines, especially in connection with marine work. It is used for spraying paint and insecticides and is the active reagent in many fire extinguishers.

Medicinal Uses.— When liquefied carbon dioxide is allowed to expand rapidly a very low temperature is produced with the resultant formation of solid carbon dioxide. This may be collected in snow-like form and has been found efficacious as a local application where the removal of warts or wens is desired.

The gas as such or dissolved in saline water has marked therapeutic effects. The carbonated baths of Bad-Nauheim have a world-wide reputation and numerous other resorts are now equipped to give the Nauheim bath treatment. The effect of immersion in such baths is to stimulate the circulation and to reduce the pressure on an overloaded heart. The action of the gas is undoubtedly reflex. Remarkable results are obtained as well with rheumatic and neurasthenic cases as with cardiac ones.

CHLORINE. Chlorine, Cl, atomic weight 35.4, at ordinary temperature and pressure is a gas of greenish yellow color and has an irritating and pungent odor. The specific gravity of the gas is about 2.48. Under pressure chlorine is easily liquefied. The specific gravity of the liquid at 15° C. is 1.425 (Lange), and the vapor tension at this temperature is 5.75 atmospheres. The boiling point of the liquid is —33.6° C. (Regnault), and its freezing point is — 102° C. The critical temperature of chlorine is 146° C. and the critical pressure is 93.5 atmospheres. The coefficient of expansion of liquid chlorine grows with increasing temperature and at 90° C. is about equal to that of gases.

Chlorine is easily soluble in water. The solution, especially under the influence of sunlight, will form hydrochloric acid under liberation of oxygen. Chlorine forms compounds with practically all elements; in many respects its resembles oxygen. It shows great affinity for hydrogen; equal volumes of chlorine and hydrogen mixed and exposed to the direct sunlight will combine under explosion, producing hydrochloric acid. If hydrocarbons are mixed with chlorine, and a flame is applied to the mixture, it will catch fire and the chlorine will combine with the hydrogen whereas the carbon will be deposited on the walls of the vessel. Chlorine attacks organic matters and destroys the lower animal and vegetable life. For human beings it is not poisonous but very obnoxious as it attacks the mucous membranes.

History.— Chlorine was discovered in 1774 by Scheele while he was treating manganese dioxide with hydrochloric acid, but up to 1809 it was considered a compound substance. At that time Gay-Lussac pointed out that it was probably an element. Investigations were made by Davy, who confirmed Gay-Lussac's opinion and gave the gas its present name. As early as

1805 chlorine was liquefied by Northmore and later on in 1823 by Faraday. Faraday heated chlorine hydrate crystals ($Cl_2 + 10H_2O$) in one branch of a sealed and bent glass tube, while the other branch was exposed to a freezing mixture. The chlorine hydrate was decomposed and liquid chlorine was obtained at the other end of the glass tube. In the laboratory chlorine is generally made by treatment of hydrochloric acid with manganese dioxide. Sometimes it is made by decomposition of hydrochloric acid by nitric acid. Commercially the «Weldon» process was formerly used to a very large extent. Weldon decomposed hydrochloric acid with manganese dioxide but added lime to the waste liquor and blew air through the mixture which enabled him to recover the manganese dioxide and use it over and over again. Later on, the «Deacon» process was largely used in which process the hydrochloric acid is decomposed by air in the presence of catalysers at a temperature of about 450° C. The disadvantage of this process is the great dilution of the produced gas so that it cannot be used when the chlorine is to be liquefied.

Commercial Method of Manufacture.— To-day by far the largest quantity of chlorine is produced electrolytically. This process frequently is called «Chlorine Alkali Process» in order to indicate the simultaneous production of chlorine and alkali. It consists of decomposing a solution of sodium chloride or potassium chloride by passing an electric current of high amperage through the electrolytic cell. The anode is generally of carbon or iron oxide and the cathode of iron. Sometimes mercury is used for the cathode. Chlorine forms at the anode and caustic soda or caustic potash at the cathode. The products of the electrolysis caustic soda and chlorine or caustic potash and chlorine must be kept strictly apart in order not to combine again. The chlorine produced by the electrolytic method has generally over 96 per cent purity, the balance being mainly carbon dioxide and air.

Commercial Uses of Gases.— By far the largest quantity of chlorine is used in the manufacture of chloride of lime or bleaching powder, which is formed when slacked lime is exposed to the action of chlorine gas. Up to the time that liquid chlorine was produced commercially nearly all shipments of chlorine were made in the form of chloride of lime and even to-day the bulk of the chlorine which is used for bleaching of textiles, etc., is shipped in this form. Prior to the commercial production of liquid chlorine most chemical works, etc., using chlorine in the manufacture of their products produced it on their premises, but since that time many users of the gas purchase the liquid which is easily transported. The first commercial plant to liquify chlorine was built in Germany in 1888 by Knietsch of the Badische Company. Knietsch used a compressor in which a body of sulphuric acid was placed between the piston and the chlorine so that the chlorine was compressed without getting in touch with the piston or the stuffing box. The compressed gas coming from the compressor entered the condenser where it was cooled and thus liquefied. In order to be suitable for shipment in steel containers the liquid chlorine had to be absolutely free from water so that it would not attack the steel. The liquid is filled into steel cylinders or tank cars. Knietsch heated the sulphuric acid in order to reduce the absorption of chlorine by the acid. This system is still used by most manufacturers, although sometimes it is used in modified form. The Linde Ice Machine Company, Germany, did not use any compressor to liquify the chlorine, but simply exposed the gas to a temperature of —45° to —50° C. at atmospheric pressure. This system is also in use commercially but not to a large extent. A third system was developed in the United States of America. In this system sulphuric acid is pumped to a high tower from where it is allowed to drop down in vertical tubes entraining the chlorine according to the injector principle. The chlorine is then again carried into a condenser where it is cooled and liquefied. This system was installed at the large government plant at Edgewater Arsenal, during the World War of 1914–18.

Not until about 1909 was any liquid chlorine made commercially in the United States, but since that time the production of liquid chlorine has grown very rapidly. It is estimated that during the year 1918, over 15,000 tons of liquid chlorine were manufactured in the United States.

Medicinal Uses.— During the war the manufacture of chlorine and of liquid chlorine grew rapidly because chlorine was used to make picric acid and very large quantities of the various poison-gases, most of which were chlorine compounds.

However, chlorine during the war was not only used to destroy human beings but also to protect them from typhoid fever and other diseases. The drinking water in the various war zones was sterilized nearly always by the use of liquid chlorine which no doubt has helped to reduce mortality from epidemics far below the figures prevailing in former wars. Nearly all large cities in the United States to-day are sterilizing their drinking water by use of liquid chlorine, which is introduced into the water main either directly as a gas or mixed with water and then introduced into the main. This application of liquid chlorine is constantly growing and a number of cities have already started to use liquid chlorine for sterilization of sewage. During the last few years liquid chlorine has started to replace chlorine of lime for bleaching purposes to a considerable extent. The detinning industry uses large quantities of chlorine to recover the tin and the steel of tin scrap according to the Goldschmidt patents. The product, tetrachloride of tin, is used in the silk industry. Zinc chloride is used to impregnate telegraph poles, railroad ties, etc., and is also used for vulcanizing fibres.

Carbon tetrachloride is used to a large extent for the extraction of fats and in the rubber industry. It is also used in dry cleaning establishments and in fire extinguishers. In the medical field chlorine is used to make chloroform, aspirin and a great many other pharmaceutical products. In the organic chemistry chlorine is used in the manufacture of synthetic indigo, sulphur colors, benzoic acids, etc. The chlorination of ores in future will probably consume very large quantities of chlorine. Consult Lunge, Dr. G., 'Hand-Buch der Soda Industrie'

(Eng. trans. as 'Manufacture of Sulphuric Acid and Alkali'), and Geoffrey-Martin, 'Chlorine and Chlorine Products.'

HELIUM, the lightest of the group of so-called "inert gases" discovered in the air by Rayleigh and Ramsay, was first observed by Janssen in 1868, when, in studying the spectrum of the solar chromosphere, he found a line in the yellow (i.e., coincident with two of the sodium lines) which was not attributable to any terrestrial substance then known. Lockyer and Frankland decided it was due to the presence in the sun of a new element which they named "helium" (Greek, *helios*, "the sun").

The first terrestrial discovery of helium was made by Hillebrand (1889, United States Geological Survey Bulletin), who, when working with the mineral uraninite, observed the evolution of a gas which gave a fluted spectrum and was attributed by him to nitrogen. When searching for argon Ramsay found helium in the gases evolved from cleveite. Its presence in the atmosphere was first observed by Kayser (1895), who detected the helium line in the air-spectrum.

It has since been shown that helium occurs in the air in the proportion of 0.000056 per cent by weight, or about one volume of helium in 250,000 volumes of air. It also occurs in many minerals, including monazite sands, in the gases of many mineral springs and is present in comparatively large amounts in several of the natural gases of Canada and the United States, particularly those of Kansas and Texas. In 1907 Cady reported 1.84 per cent of helium in the natural gas at Dexter, Kan. Helium has also been found occluded in meteoric iron.

Helium is one of the products of the disintegration of radium. The rate of production of helium is 0.37 cubic millimeter per day from 70 milligrams of radium chloride. Helium is also a product of the disintegration of actinium and of thorium radioactivity, which accounts for its presence in the gases given off by monazite sands.

Preparation.— Helium is prepared by isolation from a mixture of other gases: (1) Nitrogen, argon, krypton, neon, xenon and helium, as obtained by removal of the oxygen from air (see ARGON in this section) or as separated by fractional distillation of liquid air; (2) oxygen, nitrogen and helium as obtained from certain mineral springs. The gases from King's Well at Bath, England, contain 0.12 per cent of helium by volume and were used as a source of the gas by Rayleigh. This well is said to produce 1,000 litres (about 36 cubic feet) of helium per year.

Helium may be obtained in small quantities by heating certain minerals (such as cleveite, uraninite or monazite sand) either alone or with dilute sulphuric acid or an acid sulphate. One gram of cleveite is said to yield 3.2 cubic feet of helium, and 1,000 grams of the mineral costs about $5.

Isolation.— The French workers Jacquerod and Perrot found that quartz is permeable to helium at 1,000° to 1,200° C. so that by surrounding a quartz tube with impure helium at that temperature and pumping away the gas from the interior helium could be obtained free from nitrogen and other inert gases, but it has been shown that this process is not practicable with some kinds of quartz. Ramsay found that at the temperature of liquid air certain kinds of charcoal would absorb all gases except helium and neon. The vapor pressure of neon is so different from that of helium that a systematic repetition of the process yields a pure product.

Properties.—The density of helium has been determined as from 1.98 to 2.02. Its atomic weight is taken as 3.99. It is 0.1368 times as heavy as air.

When working with the rare gases, Olszewski obtained a sample of about 140 cubic centimeters from Lord Ramsay and tried to determine its critical constants, but found it impossible with the refrigeration means then at hand to reach the liquefaction point.

Dewar, in 1898, after obtaining liquid hydrogen, placed a sealed glass tube containing helium in the liquid hydrogen. A colorless liquid immediately condensed on the sides of the tube, but the same tube in liquid air boiling under reduced pressure gave no condensation; thus the conclusion was drawn that the boiling point of helium is very close to that of hydrogen. In 1909 Onnes first liquefied helium by cooling it in solid hydrogen and then allowing it to expand; thus showing that the ordinary liquefaction process can be applied to helium as well as to the other so-called inert gases. From 200 litres of helium gas Onnes obtained over 60 cubic centimeters of liquid helium in three hours. This liquid is colorless and its density is 0.122, which means it is the lightest liquid known. Its critical temperature is about —268° C. (5° above absolute zero). It boils at 4.5° above absolute zero and has a critical pressure of 2.26 atmospheres. Rapid evaporation of the liquid causes a temperature below 2.5° absolute or —270° C. but there is no indication of the formation of a solid.

Up to the present time helium has resisted all efforts to combine it with other elements.

The spectrum of helium is characterized by a strong line in the yellow (which has been shown to be double) and a dark green line.

Manufacture and Uses.— Helium is next to hydrogen in lightness among the elements, and this fact, together with its chemical inactivity and the fact that it is non-combustible, was the reason for its recent and much discussed application for use in balloons.

Helium has about 92 per cent of the lifting power of hydrogen. It was Sir William Ramsay who first suggested, in 1915, to Dr. Moore of the United States Bureau of Mines, the use of helium for balloons. Its buoyancy, the fact that its rate of diffusion and consequent wastage through the balloon fabric is only about one-half that of hydrogen and the freedom from fire hazard attained by its use make it an ideal balloon gas.

Certain Canadian gas wells carry approximately 0.3 per cent helium. Attempts to obtain helium commercially from this source were not successful, as the amount of helium present was comparatively small.

In 1917 interest in the use of helium for balloons was revived by Dr. Moore, on learning of its presence in the natural gases of Kansas. Late in the same year the Air Reduction Company, Inc., and the Linde Air Products Company each erected, for the United States government, a plant for the production of helium from the natural gas wells of Texas. These plants started operations early in 1918 and after some experimental work produced helium on a commercial scale. Up to the time of the signing of the armistice, November 1918, 147,000 cubic feet of 93 per cent helium had been prepared and was on the dock about to be loaded aboard ship for Europe. It was stated that at pre-war prices this quantity would represent a value of about $250,000,000. Needless to say such quantities could never have been obtained by the laboratory methods used in working with the small quantities of helium obtainable from various sources by the early methods described in the literature.

The two above-mentioned plants in Texas are now temporarily closed, but owing to the great possibilities of the use of helium in balloons, both for war and peace purposes, the United States government is planning to continue the production of helium. In addition to the two plants already built the United States government is erecting an experimental plant at Petrolia, Tex., but at this writing this installation has not produced any helium.

The three plants referred to above are all making use of gas liquefaction processes based on the removal by liquefaction of all the gases occurring in the natural product except the helium, which passes out of the system in the gaseous state.

HYDROGEN (Gr., "producing water," in reference to the fact that in burning in air or oxygen hydrogen forms water-vapor), a gaseous element, discovered by Paracelsus in the 16th century. In the year 1766, Cavendish, an English chemist, investigated this gas more thoroughly, and gave it the name of inflammable air, and, by continued investigations, in 1781 proved its elementary character. Lavoisier, finally, gave it the name of hydrogen. Hydrogen is the lightest known substance, and it also has the smallest known atomic weight. Its chemical symbol is H, its molecular formula H_2, and its atomic weight 1.008.

Physical Properties.—

Colorless, tasteless, odorless.
Specific gravity, 0.06949 (air = 1).
1 liter at 0° C., 760 mm., 0.089873 g.
1 cubic foot at 32° F., 29.92-inch pressure, .00561 pounds.
Atomic volume of liquid, 1.4.
Specific heat at 0° C. (gas), 3.410.
Specific heat of liquid, 6.00.
Atomic heat, 3.44 (gas); 6.05 (liquid).
Valence, I.
Thermal conductivity at 0° C. (Ag = 1), .000327.
Freezing (and melting) point, —259° C.
Boiling point, —252.5° C.
Density of liquid hydrogen, 0.070 (lightest liquid known).
Solubility in water, 2.1 volumes of hydrogen to 100 volumes of water.
Obeys Boyle's Law under pressure, with variations according to Van der Wall's equation.
(a = 0.00042) (b = 0.00088).
Coefficient of expansion at constant pressure (760 mm., 0—100° C.), 0.003661.
Coefficient of pressure, at constant volume (520—694 mm., 0—100° C.), 0.0036626.

Chemical Properties.—

1. Hydrogen is inflammable. In admixture with oxygen in the presence of moisture and dust and under the influence of sunlight combustion takes place slowly. With the aid of catalysts, however, e.g., finely divided Pt, Pd, Ir, Os or Au, the reaction between hydrogen and oxygen is rapid. The ignition temperatures of mixtures of hydrogen and oxygen vary between 507° and 540° C. (electrolytic hydrogen 536° C.) Hydrogen is not poisonous nor toxic.

2. Hydrogen combines directly with fluorine, even in the dark at room temperature, with explosive violence. With chlorine, it does not combine in dark at room temperature, but does when heated above 400° C. In diffused light combination is slow at room temperature. Under influence of direct sunlight (or other active rays) combination is violent. Combines directly with bromine in dark at temperatures above 400° C. and slowly even at 100° in the presence of light.

3. Hydrogen is very active chemically when occluded in certain finely divided metals, such as Pd or Pt or Os; and also when in contact with finely divided Ni, Co, Fe and Cu. In the presence of nickel many organic compounds can be reduced or saturated by hydrogen (hydrogenation of oils.

How Obtained.—Hydrogen may be obtained by:

(1) *Decomposition of Water by Metals.*—The alkali and alkaline earth metals react with water and liberate hydrogen; e.g., sodium, potassium or calcium.

Na_2 plus $2H_2O = 2NaOH$ plus H_2.

Fine aluminum turnings (containing 1—2 per cent bichloride of mercury and 0.5 per cent potassium cyanide) will decompose water at 70°; 1 kg. yielding 1,300 liters of hydrogen. (Fr. P. 392,725, 1908. Compt. rend. 1908, 147,-310).

By Metallic Hydrides.—"Hydrolith" is calcium hydride. This reacts very rapidly with water, evolving hydrogen.

CaH_2 plus $2H_2O = Ca(OH)_2$ plus $2H_2$.

Consult French patent 327,878, 1902. 1 kg. yields over 1 cu. m. of hydrogen.

(2) *Decomposition of Acids by Metals.*—When dilute sulphuric or muriatic acid is treated with an acid-soluble metal like Zn or Fe, hydrogen is formed,

H_2SO_4 plus $Fe = FeSO_4$ plus H_2.

This is the usual laboratory method for generating hydrogen gas.

(3) *Decomposition of Alkali Solutions by Metals.*—Aluminum and zinc react with aqueous solutions of the alkalis, liberating hydrogen.

Zn plus $2NaOH = Na_2ZnO_2$ plus H_2.

Very pure hydrogen is obtained in this way. Consult British patent 11,838, 1912.

(4) *Electrolysis of Water.*—This method which is of great commercial importance will be dealt with later.

Commercial Methods of Manufacture.—

(1) *Electrolysis of Aqueous Solution.*—When an electric current is passed through water containing an acid or alkali in solution, the water is decomposed, hydrogen gas being liberated at the cathode and oxygen at the anode.

Full description of methods, apparatus and production is given under the heading of Oxygen. By this method hydrogen is obtained in the largest volume, purest state and at the lowest cost. This method was originally introduced into this country by a firm of French jewelers, and the manufacture of apparatus for this purpose was initiated and perfected by the International Oxygen Company. The industry has, however, grown so rapidly that there are at the present time several firms manufacturing apparatus of this kind. Consult 'Oxygen — By Electrolysis of Water.'

(2) *Decomposition of Water by Means of Iron.*— When steam is passed over iron heated to redness, the steam is decomposed,

$$3Fe \text{ plus } 4H_2O = Fe_3O_4 \text{ plus } 4H_2.$$

The iron oxide can be reduced by means of water gas, yielding metallic iron and more hydrogen. The production of hydrogen may be made continuous by alternately passing steam and water gas through the furnaces containing the iron. Consult British patents 10,356, 1903; 17,591, 1909; 11,878, 1910.

For data regarding the physical condition of iron most desirable for this process, consult

British	patent,	27,735, 1912	Badische Co.
French	"	453,077, 1913	
U. S.	"	971,206, 1908,	A. Messerschmidt.
German	"	280,964, 1913	H. Dicka.
French	"	461,480, 1913	A. Messerschmidt.
British	"	18,028, 1913	
U. S.	"	1,109,448, 1914	
German	"	279,726, 1913,	Naher and Noding.

For further data on this method of producing hydrogen, consult:

German	patent,	263,391, 1912,	Messerschmidt.
"	"	268,062,	"
"	"	268,339,	"
French	"	444,105, 1912,	
"	"	444,106, "	
"	"	461,623, 1913.	
"	"	461,624, "	
"	"	461,625, "	
"	"	462,379, "	
British	"	12,117, 1912.	
"	"	12,242, "	
"	"	12,243, "	
"	"	17,690, 1913.	
"	"	17,691, "	
"	"	17,692, "	
"	"	18,942, "	
U. S.	"	1,109,447, 1914.	
British	"	2,096, 1913,	Badische Co.
"	"	28,390,	"
"	"	6,155, 1914.	Berlin Anhaltische Machinenbau A. G.
French	"	465,474, 1913.	
U. S.	"	1,118,595, 1914.	
"	"	1,129,559, 1915.	

Regarding the reaction of steam on iron at high pressures, consult:

Journal Soc. Chem. Ind. 32 (1913), p. 462, Bergius.

German	patent,	254,593, 1911.
French	"	447,080, 1912.
British	"	19,002, 1912.
"	"	19,003, 1912.
U. S.	"	1,059,817, 1913.
"	"	1,059,818, 1913.

Steam acts upon heated coke in the following way:

$$C \text{ plus } H_2O = CO \text{ plus } H_2.$$

The gas produced according to this reaction is called water gas.

Owing to the great difference between the boiling points of hydrogen (—252.5° C.) and carbon monoxide (—190° C.) and nitrogen (—195.5° C.) the hydrogen is best separated by liquefaction. In the Linde-Frank-Caro process water gas having the approximate composition H_2 — 48 per cent, CO — 42 per cent, CO_2 — 2.5 per cent, N — 3.5 per cent (with other impurities) is freed from CO_2 by water under pressure followed by scrubbing in alkalis. It is then dried and cooled. The carbon monoxide and nitrogen are liquefied, the hydrogen passing on in gaseous state. Consult 'Industrial Gases' by Martin and others, p. 21 and p. 39. Consult also French patents 329,839, 1903; 469,854, 1913; and British patent 13,160, 1914.

According to several methods, the carbon monoxide is taken up by suitable absorbents. For example, water gas and steam are passed over lime heated to about 500° C. (and mixed with about 5 per cent of powdered iron as catalyst). The following reaction takes place:

$$Ca(HO)_2 \text{ plus } CO = CaCO_3 \text{ plus } H_2.$$

For further details, consult:

British	patent,	2,523, 1909.
"	"	13,049, 1912.
French	"	453,187, 1912.
British	"	7,147, 1913.
U. S.	"	1,135,355, 1915.
German	"	253,705, 1910.

Hydrogenite contains 5 parts ferrosilicon (containing 90–95 per cent silicon), 12 parts caustic soda and 4 parts slaked lime. When "ignited" by a hot iron ball in a suitable apparatus hydrogen is evolved (1 kg. yielding 320 liters of hydrogen). Consult British patent 153, 1911.

Hydrogen by Decomposition of Hydrocarbons.— Hydrocarbons, such as petroleum, benzine, etc., can be decomposed by the action of steam at high temperature, yielding hydrogen and carbon monoxide. (British patent 14,703, 1911; Pictet. U. S. patent 1,134,416, 1913.)

Hydrogen is also produced by passing a mixture of hydrocarbons and steam over an inactive refractory oxide such as magnesia covered with nickel oxide (as catalyst) at a temperature of 800–1000° C. Consult

French	patent,	463,114, 1913	Badische Co.
British	"	12,978, 1913	"
U. S.	"	1,128,804, 1915	"

Natural gas, vaporized oil or casing-head gasoline, when passed through red-hot pipes, are decomposed and deposit lampblack and form an impure hydrogen (impurities are methane, carbon monoxide and traces of oil vapor).

Very pure hydrogen, according to Bergius, may be produced by the reaction between water and iron at sufficiently high pressure to prevent vaporization of the water.

The following table gives the experimental data on the liberation of hydrogen by this method:

Charge							
Fe g	Cu g	H_2O g	$FeCl_3$ g	Temp. °C.	Time Hrs.	Volume of gas generated C C	Volume of gas per hr. C C
50	..	100	..	300	3:30	800	230
50	..	100	3	300	3:30	4,650	1,330
50	25	100	3	300	3:00	5,800	1,930

The electrolyte, ferric chloride and the copper (electropositive to iron) increase the reaction velocities enormously. For fuller details consult

Journal Soc. Chem. Ind. 32 (1913), p. 462.

German	patent,	254,593, 1911.
French	"	447,080, 1912.
British	"	19,002, 1912.
"	"	19,003, 1912.
U. S.	"	1,059,817, 1913.
"	"	1,059,818, 1913.

Commercial Uses.— When hydrogen is burnt in oxygen temperatures up to 2,800° C. may be obtained. This property renders hydrogen invaluable for fusing and welding platinum, iron, lead, copper, etc. Hydrogen and oxygen obtained from cylinders of the compressed gases are brought together in a suitable burner and ignited.

It is well known that rapid cooling of hot metals hardens them. That the opposite is true has recently been demonstrated in striking fashion by the General Electric Company. One of its scientists annealed American ingot iron surrounded by hydrogen gas for three hours at a temperature above 1,600° F. The product was very little harder than the softest copper, and could be whittled with a knife. (Taken from *American Machinist.*)

Below are given some of the present principal commercial uses of hydrogen:

1. *Hydrogenation of Oils.*— Solidifying liquid oils for edible products; preparing fats for manufacture of soap; renovating and deodorizing certain oils.
2. *Metallurgical.*— Reduction of copper oxide; reduction of tungsten; reduction of molybdenum; lamp work; jewelry work.
3. *Aeronautical.*— Balloons, dirigibles; portable wireless stations.
4. *Cutting.*— Oxy-hydrogen cutting. (The oxy-hydrogen flame is far superior to any other method for cutting metals and will cut metals of such thicknesses as to be beyond the penetration of the oxy-acetylene flame).
5. *Platinum and Lead Melting.*— Lead chambers for sulphuric acid.
6. *Chemical.*— Reducing agent; combining agent.
7. *Fuel.*— Heating.
8. *Annealing.*

Hydrogen has been used with some degree of success in the manufacture of ammonia synthetically by the Haber process. Hydrogen and nitrogen are combined at high pressures, and temperatures around 500—600° C., with the aid of catalysts. The process has been developed to a much greater extent in Germany than in the United States. During the recent World War a plant was erected by the United States government at Sheffield, Ala., for the manufacture of ammonia and thence ammonium nitrate by a modified Haber process. Although some ammonia was produced, continuous production was not achieved owing to the mechanical difficulties involved in working with gases at high pressures.

Hydrogen is used in steel works for autogenous welding and for filling up the blow-holes frequently found in steel castings.

Limelight is produced by impinging an oxy-hydrogen flame on a block of quicklime, yielding a very brilliant light (Drummond light).

In glass works, the heating of furnaces and crucibles is greatly accelerated by the oxy-hydrogen flame. In the preparation of fused silica ware the oxy-hydrogen flame is extremely valuable.

Hydrogen finds extensive use for filling balloons. Theoretically, the ascensional force of hydrogen is the difference in weight of a cubic metre of air and a cubic metre of hydrogen (1.293—0.090 kg.) and is thus 1.203 kg., except at higher altitudes. Practically 1 kg. is taken as the lifting force of 1 cubic metre of hydrogen.

Synthetic sapphires, amethysts, emeralds, rubies, etc., are made by the deposition of alumina and fusion in the oxy-hydrogen flame.

Recently hydrogen has found a very valuable application in the hydrogenation of oils.

The saturated glycerides and fatty acids have higher melting points than the unsaturated compounds:

$$\underset{\text{(Oleic Acid)}}{C_{18}\,H_{34}\,O_2} \text{ plus } H_2 = \underset{\text{(Stearic Acid)}}{C_{18}\,H_{36}\,O_2}.$$

In this way various soft oils and fats, such as fish oil, linseed oil and cottonseed oil, are hardened and their commercial value increased. The higher melting point fats are advantageously used in soap making, candle making and edible fats (such as butter and lard substitutes). Consult Martin's 'Industrial Chemistry'; Ellis, C., 'Hydrogenation of Oils — Catalysis — Generation of Hydrogen and Oxygen'; Thorpe, 'Dictionary of Applied Chemistry'; Martin, G. F., 'Industrial Gases.'

LIQUID AIR. Liquid air varies in composition. It boils at about —190° C. and contains by weight 54 per cent of oxygen (air, 23.2 per cent oxygen). Many interesting experiments can be performed with liquid air aside from its use by scientific investigators. The properties of familiar substances are greatly changed by the low temperatures attainable by its use: e.g., rubber becomes brittle, milk becomes highly phosphorescent, an egg is a shining blue globe, photographic films lose most of their sensitiveness; sodium, potassium and even phosphorus are unaffected by liquid air; metals lose their electric resistance to a remarkable degree; the magnetic moment of magnets is greatly increased; curiously, the various bacteria and low forms of life, while rendered inactive by the intense cold, recover their activity on being brought back to normal temperatures and the germinating power of seeds is unimpaired.

Experimental work with liquid air or gases naturally calls for a container. Liquid air is preserved in an open container of a design called a "Dewar bulb"— a double-walled glass bulb, the space between the walls being completely exhausted of air and the glass being silvered like a mirror to reflect radiation. This is, of course, the principle of the ordinary thermos bottle.

NEON. In 1898, Sir William Ramsey discovered this gas in the atmosphere. He secured it by means of the distillation of liquefied air. Claude has since developed the process of separation of the elements of the air by liquefaction to a point which allows the production of Neon as an industrial product suitable for use for commercial purposes. Neon is found in the atmosphere in the very small proportion of one part of Neon to 66,000 parts of air. It belongs to the group of inert gases, i.e., those which do not combine chemically with other elements, and, like the other inert gases, is monatomic. Its valence is 0.

Physical Properties.—
Chemical symbol, Ne.
Colorless, odorless, tasteless.
Atomic weight, 20.2.
Specific gravity, 0.695 (Air=1).
Boiling point, —243° C.
Melting point, —253° C.
Critical temperature, <—205° C.
Critical pressure, 29 atmospheres.
Spectrum consists of green lines and several orange lines.

Neon has been proved to be monatomic by determining the ratio of its specific heat at constant pressure to its specific heat at constant volume.

Commercial Uses.— When a tube containing Neon is rarefied it is readily permeated by an electric discharge. Neon has found a limited use commercially as a gas for filling tubes for the production of light by the passage of an electric current through the tube. Difficulties have been met in employing it in this way because it is sensitive to the presence of the smallest quantities of other gases, and its luminous properties are entirely overcome by them. Claude has devised a process of removing this difficulty by utilizing the absorbent properties of charcoal when cooled, which were discovered by Dewar. This is done by purifying the Neon in the tube during the passage of the electric current, by means of charcoal, the temperature of which has been lowered by liquid air. When the impurities have been removed in this manner and the Neon left, the tube is separated from the charcoal receptacle.

Neon tubes used in lighting have an advantage over nitrogen tubes in that the candlepower is much greater and the efficiency better. A disadvantage is that the light produced is too red because there is an absence of blue rays. This quality is desirable, however, in display illumination where the dazzling light produces a beautiful effect. Neon tubes were used in 1910 in Paris for lighting the Grand Palace on the Champs Elysées. Their use, however, has not been developed commercially to any extent.

NITROGEN, a colorless, odorless gas, noninflammable under ordinary conditions and non-explosive. The density of pure nitrogen under normal temperature and pressure conditions is 0.96737. The density of atmospheric nitrogen (containing the inert gases) is 0.97209. The atomic weight of nitrogen is 14.01. The critical pressure is 35 atmospheres, and the critical temperature —146.25° C. The melting point of solid nitrogen is —210.5° C., and the boiling point of liquid nitrogen —195.5° C. The nitrogen thermometer is used in modern precise thermometry, and the following constant was determined with the greatest possible care: If a given mass of nitrogen at initial temperature of 0° C. and pressure of one meter of mercury be heated at constant volume to 100° C., its pressure becomes equal to that due to 1.36745 meters of mercury.

Historical.— Nitrogen was first recognized as a distinct substance by Rutherford of the University of Edinburgh in 1772. His demonstration consisted in showing that when a small animal breathes the air in an enclosed space for a while, and the carbon dioxide produced is removed by absorption, there still remains a gas that is incapable of supporting respiration. The individuality of nitrogen and its existence in the atmosphere was first demonstrated by Lavoisier, who named it «azote,» signifying «without life.» The French still call nitrogen by this name, the English name being derived from the Latin «nitrum,» meaning saltpetre.

Occurrence.— Nitrogen is one of the most widely distributed elements. In the free form it makes up 79 per cent by volume of the atmosphere, or 77 per cent by weight. It also occurs in the air in chemical combination as nitric and nitrous acids as well as ammonia, but in only small quantities, it being estimated that the nitrous gases are present to the extent of about one part in 3,000,000. Nitrogen is found in volcanic gases, in the air-bladders of certain fish, the bone cavities of birds, the cavities of plants, in meteorites, in the nebulæ and in the atmosphere of the sun. Nitrogen is found in many forms in combination with other elements. It occurs as an essential constituent in vegetable and animal matter in the form of proteins which average about 16 per cent nitrogen. It is found in Bengal in the form of potassium nitrate (saltpetre) and in Chile and Peru in the form of sodium nitrate (Chile saltpetre). Quantities of combined nitrogen are obtained in the form of ammonia by destructive distillation of coal. The natural manures, such as the guanos, also contain considerable combined nitrogen.

Preparation.— There are various ways of obtaining nitrogen from the air by use of chemicals to absorb the accompanying oxygen. Such nitrogen is never more than 99 per cent pure, as the inert gases (see ARGON) are still present. Nitrogen is also obtained from combustion gases, for example, from gas producers, and it can, of course, be obtained by factional distillation of liquid air, the average purity by this method being about 99.9 per cent nitrogen.

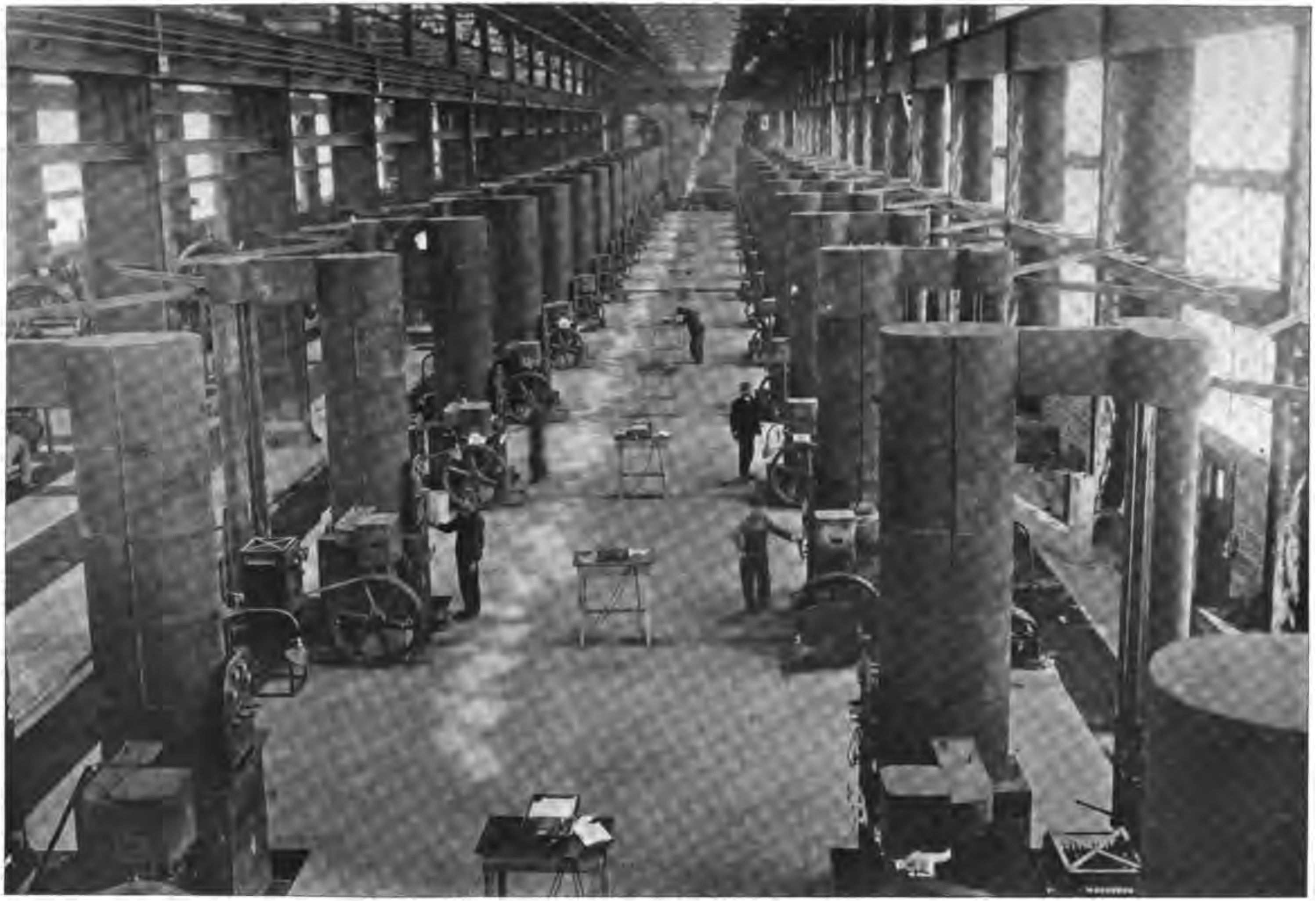
In order to obtain pure nitrogen the earliest experimentalists resorted to chemicals. The simplest method is to heat ammonium nitrite, but as this compound is somewhat unstable and inclined to decompose, the same result is obtained by using the more stable form — sodium nitrite; this is mixed with ammonium chloride, and when heat is applied to the mixture, ammonium nitrite is formed and immediately decomposes into water and pure nitrogen. It is also possible to obtain pure nitrogen from air by means of metallic nitrides. Nitrogen combines directly with lithium, calcium and magnesium when heated. These nitrides, on further heating, again give up their nitrogen. Comparatively pure nitrogen is obtained in large quantities as a residue from the carbonating towers in the Solvay plants for making soda by the «ammonia-soda» process.

Compounds of Nitrogen.— Although there are so many chemical compounds of nitrogen, it is a very indifferent or inert element as compared with the activity of oxygen. One of the great problems of science has been the so-called «fixation» of nitrogen and it cannot be said that the problem is at the present time by any means satisfactorily solved. Granting, however, that the nitrogen has been fixed, whether naturally or synthetically, in the form of nitric acid or ammonia or their salts, the compounds are many of them intensely active; e.g., nitric acid, and the well-known explosive, nitroglycerine, T.N.T. and picric acid. The literature of the nitrogen compounds is very extensive and new work is constantly being reported on the thousands of derivatives of nitrogen. Nitrogen does not combine with oxygen under ordinary conditions. The combination takes place under the influence of an electric spark, and such a combination always accompanies lightning. For this reason, some oxides of nitrogen are always present in rain water but the small amounts thus formed could scarcely have supplied vegetation throughout the ages. Certain classes of plants, notably legumes (alfalfa, cowpeas, soy beans, etc.), are provided with means of taking up the free nitrogen from the atmosphere by the assistance of bacteria which flourish on the nodules of the roots of the plants. These bacteria have the power of converting the free nitrogen of the air into compounds which in turn are taken up by the nodules and assimilated by the plants, sometimes to the extent of over 5 per cent of combined nitrogen, in the form of proteins. A great deal of work has been done on designing suitable apparatus for the combination of nitrogen and oxygen by electric means, but the process is still only commercially possible where water power is very cheap, as in the plants in Norway.

The combination of nitrogen with oxygen was first brought about by Cavendish in 1785. The use of the electric arc was introduced by Sir William Crookes in 1892. The commerical manufacture of nitric acid was attempted at Niagara Falls in 1902 by Bradley and Lovejoy, who subjected a mixture of oxygen and nitrogen or air enriched with oxygen to a high tension arc drawn out as long as possible. Mechanically and chemically the operation was a success, as the efficiency of the process was greater than that obtained by Birkeland and Eyde in Norway in 1903. Nevertheless, the cost of power is high at Niagara Falls, and financial backing for the development was lacking, so that the work was discontinued. In Norway, where power is much cheaper, arc processes are now being operated on a large scale. With oxygen, nitrogen forms five oxides as follows: (1) Nitrous oxide (N_2O) is prepared by cautiously heating ammonium nitrate. Some of its properties are similar to those of oxygen, in that it supports the combustion of certain materials, such as phosphorus, which also burn easily in oxygen. On the other hand, metals do not rust in it, and the hæmoglobin of the blood cannot use it as a source of oxygen. Davy noticed that when taken into the lungs, it produced a mild form of intoxication or hysterical condition, which gave rise to the name of "laughing gas" by which it is commonly known. Prolonged use of the gas produced insensibility. As a result of these observations, a method of using it as an anæsthetic has been worked out, the method consisting of the admixture of a sufficient amount of oxygen or air to sustain life. It is thus employed for minor operations, such as dental work, or preceding the use of ether, and when properly used has practically no after effects; (2) Nitrogen dioxide (N_2O_2) or nitric oxide (NO) was discovered by Priestley, who called it "saltpetre-gas." This is a colorless gas commonly prepared by acting upon metallic copper with cold dilute nitric acid. Nitric oxide combines directly and readily with oxygen, the combination taking place promptly upon contact with air, the brown colored higher oxides of nitrogen being formed. The dioxide may be liquefied by the application of cold and pressure; the critical temperature is 93.5° C. and the critical pressure 71.2 atmospheres. The solidified gas melts as about 167° C.; (3) Nitrogen trioxide or nitrogen sesquioxide, N_2O_3, may be prepared (though in rather an impure state) by the action of nitric acid upon starch, or upon arsenic trioxide. It is a reddish gas, which condenses to a volatile blue liquid upon being cooled by a freezing mixture. Nitrogen trioxide also dissolves in ice-cold water with the formation of a blue liquid containing nitrous acid, HNO_2. (See NITROUS ACID). On account of the difficulty of preparing this gas in even a moderate degree of purity, its chemical and physical properties have not been determined with any degree of exactness; (4) Nitrogen peroxide, N_2O_4, formerly known as the "dioxide" (NO_2) may be prepared by heating dry nitrate of lead, which breaks up into lead oxide, oxygen and nitrogen peroxide. It is a dark orange-colored gas, which has the molecular formula N_2O_4 at low temperatures, for which reason it is also called the "tetroxide." At 150° C. the gas has the molecular formula NO_2, as is proved by its density: and at ordinary temperatures it consists of a mixture of NO_2 and N_2O_4. At about 188° C. a further dissociation into nitric oxide and oxygen begins, this increasing as the temperature rises, until, at about 565° C., the dissociation into nitric oxide and oxygen is complete. Nitrogen peroxide is easily liquefied and solidified. At temperatures lower than —8° C., it is a white, deliquescent, crystalline solid, which on heating slowly melts to a colorless liquid, becomes yellow when warmed to 0° C., and orange at 20° C. Under ordinary atmospheric pressure it boils at about 22° C., with the evolution of the gaseous peroxide; (5) Nitrogen pentoxide or nitric anhydride, N_2O_5, may be prepared by dehydrating concentrated nitric acid by the cautious addition of phosphorous pentoxide, or by passing chlorine gas over dry silver nitrate. The pentoxide is solid at ordinary temperatures, and may be obtained in the form of white, lustrous, translucent prisms, which have a specific gravity of about 1.64, and melt at 3° C. with partial decomposition into the peroxide and free oxygen. At about 46° C. the liquid boils. The pentoxide combines with water to form nitric acid (q.v.).

Ammonia.— Under very high pressures (175 to 200 atmospheres) and at high temperatures, (approx. 600° C.) with the assistance of a catalyst, nitrogen and hydrogen can be combined directly, forming ammonia (NH_3). The first commercial development of this process was accomplished by Haber and his associates in Germany in 1910. The apparatus used is difficult to construct, and the catalyst is easily rendered inactive, yet Germany made considerable quantities of ammonia by this method during the war: the costs of production by this process, however, have not been disclosed.

Large quantities of ammonia have been manufactured during the last few years by the so-called Cyanamid process, in which calcium



Installation of thirty Claude System Liquid Air Machines for the production of 15,000,000 cubic feet pure nitrogen per day. Erected at Muscle Shoals, Ala., by Air Reduction Company

carbide is first manufactured in an electric furnace; this carbide is ground fine and subjected to the action of nitrogen in suitable ovens. The resulting product is called Cyanamid and contains 20 to 23 per cent nitrogen. By subjecting this Cyanamid to steam, under pressure, almost the theoretical yield of ammonia is obtained. The method has been in operation in Europe for some time as well as at Niagara Falls, Ontario. (See CYANAMID). Several processes for the production of NH_3 through the intermediate formation of cyanides are in process of development and show promise of successful operation. In these processes a mixture of alkali metal compound and carbon, with or without a catalyst, is subjected to the action of nitrogen at a temperature of approximately 1000° C. Cyanides are produced which, by the action of steam, are converted into ammonia and a residue which can be returned to the cycle of operations. (See CYANIDES). Ammonia can also be obtained by the hydrolysis of suitable nitrides. This process was first introduced by Serpek in Italy. Interest in this process has recently been revived and one or more plants are in prospect. The process depends upon the reduction of alumina in one form or another by means of carbon at a very high temperature in the presence of nitrogen. The aluminum nitride thus formed is afterward subjected to the action of steam, producing ammonia and alumina. Notwithstanding the methods described above, the fact remains that the world still depends upon nature to supply the bulk of the ammonia required and until comparatively recently nearly all of our ammonia came from the destructive distillation of coal. An oily liquid known as chloride of nitrogen (NCl_3) is formed by passing chlorine through a solution of ammonium chloride or, more conveniently, electrolyzing a solution of ammonium chloride. This compound is one of the most dangerous explosives known. A number of synthetic nitrogen compounds, not found in nature but now widely used, are of great importance. In addition to the oxides and ammonia mentioned above, there are such derivatives of nitric acid as nitroglycerine, gun cotton and a series of so-called «azo-compounds,» which are either dyes or intermediates in the manufacture of dyes. A number of alkaloids that contain nitrogen show considerable physiological activity and are of importance as medicines.

Uses.— Free nitrogen gas is used in very large quantities in the manufacture of cyanamide, cyanides and synthetic ammonia. It is also used in the incandescent lamp industry as the filaments last much longer and give greater efficiency in an atmosphere of nitrogen than in one of air. Nitrogen is likewise finding an increasing number of applications as an inert gas in various manufacturing operations, for instance where oxidation is to be avoided. Certain compounds of nitrogen, e.g., nitrates, ammonium salts and cyanamid (nitrolim), are used in enormous quantities as fertilizers. Nitric acid and an almost endless list of nitro compounds obtained by treatment of various organic materials with nitric acid are used in very large quantities in the manufacture of dyes and explosives, drugs, celluloid and similar products. Ammonia is used in large quantities in ice machines and in the manufacture of soda by the Solvay process. Cyanides are used for the extraction of the precious metals from their ores and also in considerable quantities in the electroplating industries, as well as in the manufacture of numerous small amounts of chemicals useful in the practical arts.

Bibliography.— Boyce, John C., ‹Bibliography of the Production of Synthetic Nitric Acid and Synthetic Ammonia› (in *Metallurgical and Chemical Engineering*, Vol. XVII, p. 328, 1917); ‹Reference List Electrical Fixation of Atmospheric Nitrogen, etc.,› Bulletin No. 63, United States Bureau of Soils; Literature of the Nitrogen Industries, 1912–16, originally published serially in the *General Electric Review* and later assembled in the *Journal of Industrial and Engineering Chemistry*, pp. 424–438 (1917); Thorpe, ‹Dictionary of Applied Chemistry› (Vol. III, pp. 676–712, 1916).

NITROUS OXIDE. Nitrogen monoxide — nitrous oxide — laughing gas — N_2O — specific gravity 1.52 — atomic weight 43.76. A colorous gas possessing a pleasant, slightly sweet smell and taste. Used largely by surgeons and dentists — preferably with a small admixture of oxygen as a general anæsthetic. It is not inflammable and not explosive except in the presence of some easily oxidizable material when it acts in manner similar to oxygen under same conditions. Soluble in water to the extent of approximately one volume at ordinary temperatures and atmospheric pressure. Much more soluble in alcohol and many of the volatile oils. At temperatures below its critical point (30° C. — 86° F.) it is readily liquefied by pressure. Its critical pressure (tension of the gas at its critical temperature) is 75 atmospheres. At temperatures below the critical the tension of the saturated vapor is approximately as below:

—100° C.— Freezes.
— 88° C.— 15 lbs. (Atmospheric pressure).
0° C.— 30 Atmospheres.
+ 7° C.—50 Atmospheres.
+ 20 — 60 Atmospheres.
+ 55 — 116 Atmospheres.

The liquefied gas is a colorless and very mobile liquid having a specific gravity of 0.9369, freezes at — 100° C. and expands rapidly when heated — is not miscible with water but dissolves or mixes readily with alcohol — chloroform — ether and the volatile oils generally. It is also a ready solvent of many gums and hydrocarbons.

If a cylinder containing the liquefied gas be immersed, valve up, in a freezing mixture of ice and salt, in order to condense and freeze any moisture present, and then after attaching a short bent delivery tube to the valve, be inverted with the tube extending into a glass flask and the valve cautiously opened, the first liquid flowing will evaporate with great rapidity and some spluttering until the temperature of the tube and flask are sufficiently reduced, when the liquid will collect in the flask and may be retained for a considerable period. If the liquid be agitated or the gaseous atmosphere over the liquid be removed by blowing with the mouth or otherwise, the surface will be immediately covered by a thin film of the frozen gas. In this or similar experiments great care is necessary to prevent the liquid or frozen gas from striking the unprotected skin, as it will quickly freeze the surface and produce an ugly sore similar to that produced by contact with molten lead or other metal.

History.— Nitrous oxide was first prepared by Priestley in 1772 by deoxidizing nitric oxide — NO. In 1823 the gas was liquefied by Faraday by heating anhydrous nitrate of ammonia contained in one limb of a hermetically sealed glass tube bent in the middle at an obtuse angle. The gas together with the water vapor formed by the decomposition of the salt distilled over into the cooled end of the tube and both being condensed by the pressure and cold to liquids — the gas collected on top of the water.

Through the experiments of Natterer of Vienna and Bianchi of Paris (1845) carbonic acid — nitrous oxide and some other gases were liquefied on a semi-commercial scale by the use of a small but powerful pump specially constructed for the purpose. The pump cylinder of small diameter and long (not unlike a gun barrel) was cooled by a water jacket and delivered the gas in successive charges through an automatically operated valve into a strong iron reservoir which was surrounded by ice or a freezing mixture.

Many early observers called attention to the peculiar physiological effects of the gas when breathed: in some instances it would seem probable that they must have made use of an impure gas in their experiments. In 1809 Sir Humphrey Davy mentions among these effects intoxication and ultimate loss of consciousness and even suggests its use as an anæsthetic. This suggestion bore no fruit until 1844 when Mr. G. O. Colton in the course of a lecture or entertainment given at Hartford, Conn., administered the gas to a number of individuals from his audience and among others to Mr. Samuel A. Cooley, who in the course of the antics induced by breathing the gas injured his leg quite severely. Upon coming out from under the influence of the gas Mr. C. stated that he had no recollection of the injury nor did it give him any pain. Dr. Horace Wells, a dentist of Hartford who was present, immediately suggested the use of the gas as an anæsthetic in the extraction of teeth.

Within a few days Dr. Wells arranged to put his idea to a test. Mr. Colton administered the gas to Dr. Wells, and Dr. J. M. Riggs, also a Hartford dentist, extracted a tooth from Dr. Wells' mouth. This experiment was a complete success, and monumental, being the first recorded instance of a painless surgical operation under the influence of a general anæsthetic. Dr. Wells made use of the gas in a number of minor surgical operations, but, owing to crude methods and imperfect apparatus, with varying success. Dr. Wells died a little later, and the anæsthetic properties of sulphuric either and chloroform being discovered, the anæsthetic properties of nitrous oxide were apparently forgotten until the year 1862, when its use was revived, this time in New Haven, Conn.

In July 1863 Mr. Colton, in conjunction with a number of influential dentists, organized the Colton Dental Association and opened an office in New York City for the painless extraction of teeth, nitrous oxide being the anæsthetic employed. This venture proved a great success, and in 1881 Dr. Colton reported 121,709 administrations of the gas at the office of his association and with no accidents. In a catalogue of surgical instruments and apparatus issued by James Coxeter & Son of London, England, in 1870 we find cuts and price lists of iron cylinders containing the liquefied gas together with inhalers and other apparatus. This is without doubt the first instance of the commercial development of the liquefied gas industry.

Coxeter apparatus was brought to American immediately upon its introduction to the dental profession in England, and various sizes of iron cylinders, containing from 100 to 1,000 gallons of the gas, soon became common in the American dental trade. The liquefied gas was first produced commercially in this country by Johnston Brothers of New York City, who developed and patented improved compressing methods and machinery, and who later united with S. S. White of Philadelphia, continuing the manufacture under the name of The S. S. White Dental Manufacturing Company.

Commercial Method of Manufacture, Etc. — Nitrous oxide may be made by a number of methods depending upon the deoxidation of the higher oxides of nitrogen, as, for instance, by the action of dilute nitric acid upon zinc or iron. An impure gas may be made also by heating a mixture of ammonium sulphate and nitrate of soda or potash in a closed retort. The general commercial method for its manufacture, however, is by heating in a closed glass or metal retort having a proper protective lining a pure fused nitrate of ammonia. At a temperature of about 170° C. the salt fuses completely and at temperatures between 240° and 260° C. gives off gas freely — the latter temperature should not be exceeded.

The formula of the reaction is:

$$NH_4NO_3+Heat=N_2O+2H_2O.$$

It thus appears that the nitrate of ammonia is completely decomposed, each molecule breaking up and forming one molecule of nitrous oxide gas and two molecules of the vapor of water or steam. The products of the distillation are cooled, the steam being of course condensed to water, and then having passed through proper washing apparatus the gas is collected in a holder from which it is taken by pumps and compressed into steel cylinders. Among the concerns now engaged in the manufacture of nitrous oxide are the Lennox Chemical Company and the Ohio Chemical Company, both of Cleveland, Ohio, The S. S. White Dental Manufacturing Company of Philadelphia, Pa., and the Standard Oxygen Company of New York City.

The American Red Cross has, it is said, constructed in France at Montreux a large plant capable of producing and liquefying 100,000 gallons of N_2O per day, and for a few months previous to the signing of the armistice N_2O was very largely used in the army and navy hospitals with great success. The annual production of N_2O in America is variously estimated at from 10,000,000 gallons (133,333 cubic feet) to three times this figure.

OXYGEN. Historical.— Oxygen was recognized by its properties as far back as the 8th century among the Chinese who knew that the «active» component of the air combines with some metals, with sulphur and with charcoal and that this active component could be obtained pure from saltpetre and certain other minerals. Leonardo da Vinci (1451–1519) was the first European to state that the air contains two gases, but it was not until 1774 that Joseph Priestley made the first pure sample of oxygen. It is true that Scheele, a Swedish apothecary, had made oxygen in 1771–72 from at least seven different substances, and that he had made quite an extensive study of its combination with various materials, but as his results were not printed until 1777, Priestley is generally considered the discoverer of oxygen. Many other chemists worked on air and the commonly known gases at that time, and these studies furnished the material on which Lavoisier, the great French philosopher and scientist, based his conclusions which may be said to form the foundation of modern chemistry. The name oxygen (meaning acid-torming) was given to the gas by Lavoisier who at that time thought it was an essential constituent of all acids.

Occurrence.— Oxygen is the most widely distributed element in nature and it has been estimated that it makes up nearly half of terrestrial matter. It forms approximately 21 per cent by volume of the atmosphere; it makes up eight-ninths by weight of all the water on the globe; more than three-fifths of the human body; nearly half of three of the chief constituents of the earth's crust, namely, silicious rock, chalk and alumina. Many other minerals contain oxygen in considerable proportions. It is an essential constituent of all living organisms, aside from its existence in the water of the tissues. It is absorbed by all animals during respiration and is given off in the free state by growing vegetable organisms when exposed to sunlight.

Preparation.— Pure oxygen is best prepared in small quantities from one of the many substances in which it occurs in chemical combination.

I. Heat applied under the proper conditions causes oxygen to be liberated from the following compounds: oxides of mercury, silver, gold and platinum; peroxides of hydrogen, barium, lead and manganese; chlorates, nitrates, bichromates, etc.. of potassium and other metals. Of chief interest are the following:

1. Ignition of nitre, which gives up only one-third of its oxygen. Priestley first obtained impure oxygen in this manner in 1771.

2. Ignition of mercuric oxide, the method used by Priestley on 1 Aug. 1774, when he made the first pure oxygen.

3. Heating manganese dioxide, formerly one of the cheapest methods of commercial preparation of oxygen, and the one used by Scheele.

4. Heating potassium chlorate alone or preferably with about one-eighth of its weight of manganese dioxide, or a little spongy platinum. Oxygen prepared in this way usually contains chlorine which can be removed by caustic soda solution. The manganese dioxide (pyrolusite) should be tested as the occasional adulteration of it with coal dust has been the cause of fatal accidents.

II. A convenient laboratory method for the preparation of pure oxygen is to treat «oxone» (a convenient form of sodium peroxide) with water. This material is prepared in a handy form especially for this purpose.

III. The electrolysis of water made slightly acid with sulphuric acid furnishes pure oxygen, which is liberated at the positive pole, and at the same time twice the volume of hydrogen is liberated at the negative pole.

Properties.— Oxygen is a colorless, tasteless and odorless gas. It is 1.1056 times as heavy as air. Owing to the large number of elements that combine with oxygen, it has been selected by the International Committee on Atomic Weights as the standard of comparison for all atomic weights, that of oxygen being 16 (according to this scale the atomic weight of hydrogen is 1.008).

Oxygen was first liquefied in 1877 but was not obtained in the liquid form in considerable quantities until 1883. (See Liquefaction of Gases, p. 495). Liquid oxygen is a pale, steel blue, transparent liquid when in considerable masses. The density of liquid oxygen at —182.5° C. is 1.1181; the density of solid oxygen is 1.4256 at —252.5° C. The critical temperature of oxygen is — 118° C., and the critical pressure 50 atmospheres. At atmospheric pressure, the boiling point is —182.5° C.; the melting point is —218° C.

One volume of liquid oxygen at —182.5° C., if allowed to evaporate, furnishes an amount of gas which, at 0° C. and atmospheric pressure, occupies a volume 782 times that of the original liquid taken.

In a Geissler tube, oxygen shows a luminous spectrum containing a bright band in the red, two in the green and one in the blue, but the spectrum is said to vary under varying conditions.

Oxygen is slightly soluble in water. Its introduction into all animal life is by this means. Fish get the oxygen for their blood directly from the water in which it is dissolved. Among the air-breathing animals, including mankind, the process is not so obvious; the air is breathed into the lungs, oxygen is absorbed by the moisture in the walls of the air sacs of the lungs and thus passes into the blood in the dissolved state.

While the oxygen of the air supports respiration, and oxygen is the only gas suitable for this need of animal life, the proportion found in air is the one to which all life has become adjusted. Pure oxygen can be inhaled for a while with safety, but only relatively small amounts are required to produce a sense of narcotism in a normal, healthy person. A continued supply of pure oxygen furnished to a small rabbit caused it to eat voraciously but nevertheless it became very much emaciated from lack of ability to assimilate the food so rapidly. Under certain conditions, the animal became speedily narcotized, and the supply of pure oxygen had to be discontinued to prevent its death. The cold-blooded animals were found to be very little affected, but most of the warm-blooded animals experimented upon speedily showed symptoms of great weakening. Oxygen, however, has been found very efficient in restoring persons overcome by noxious gases, and also, judiciously used, in the treatment of certain affections of the lungs.

Oxygen forms oxides by direct combustion with nearly all other elements, the only exceptions being argon, bromine, chlorine, fluorine, gold, helium, iodine, neon, platinum and silver. Most of the non-metallic elements combined with oxygen form acid anhydrides; hydrogen forms a neutral oxide, water. A few of the metals in the molten state absorb oxygen which is given off again when the metal solidifies. Heated at 450° C., silver takes up about five times its volume of oxygen, gold 35 to 40, platinum 65 to 75 and palladium about 500 times its volume. Finely divided platinum absorbs about 100 times its volume of oxygen and palladium sponge about 1,000 times. Certain substances absorb increasing amounts of oxygen as the temperature is lowered, and give it off again as the temperature is increased; on the contrary, wood charcoal absorbs about 18 times its volume of oxygen at ordinary temperatures, but as the temperature is lowered, it takes up increasing quantities of oxygen, so that at —185° C. one volume of charcoal absorbs 230 volumes of oxygen.

Liquid oxygen is a very perfect insulator and is a comparatively inert substance; phosphorus, sodium, potassium, etc., may be immersed in it without any reaction taking place.

Oxygen is non-inflammable *per se* but its combination with other elements or materials with evolution of heat and light is commonly known as «combustion,» and the material combining thus with oxygen is said to be «inflammable»; examples are, burning of wood, coal, gas, etc.

Many combinations with oxygen, however, are not accompanied by light or extreme generation of heat, and these are classed, along with the combustion described above, under the term «oxidation,» a familiar example being the rusting of iron.

All substances which burn in air burn with very much greater brilliancy in pure oxygen, and many which refuse to burn in air can be burned quite easily in oxygen. Thus, an iron wire, if previously heated to the ignition temperature, burns with dazzling brilliancy in oxygen; even the diamond (dense form of carbon) if heated to redness and then plunged into oxygen burns readily without further application of heat. Further, the temperature of a hydrogen or coal gas flame burning in oxygen is very much higher than that of the same gas burning in air. Some of the less obvious cases of slow oxidation are of particular interest. The bodily heat of all animals is furnished by the oxidation of certain constituents of the blood as it passes through the lungs, the oxygen being furnished by the air. Slow oxidation of organic materials, which otherwise would cause discomfort or disease, takes place universally in nature so that the waters of streams automatically purify themselves by absorbing oxygen from the air; this process is imitated when large volumes of pure water are mixed with sewage, thus introducing dissolved oxygen which, aided by bacteria, rapidly renders the organic matter harmless. Not all slow oxidations are beneficial, however. In cases where circulation of air through large masses of material is sufficient for slow oxidation but not for carrying off the heat generated, there may be sufficient accumulation of heat to bring about actual combustion; the result of such so-called «spontaneous combustion» may be a burning hay-stack, a fire in the coal bunkers of a ship or a burning building set fire by a collection of greasy waste rags or tow that has slowly heated itself up to the burning temperature. Insurance companies have very strict rules concerning the disposal of such waste as many serious conflagrations have resulted from such causes.

Somewhat similar and exceedingly dangerous are the explosions of finely divided materials which in their ordinary form are considered anything but explosive. Finely divided coal dust mixed with air has been the cause of many disastrous mine explosions and fires. In 1878 a tremendous explosion in the Washburn Flour Mills in Minneapolis, Minn., demonstrated the fact that any finely divided carbonaceous material constitutes an explosive substance when mixed with certain proportions of air. Indeed, many finely divided metals which ordinarily do not burn in air or oxygen will burn readily in an ordinary gas flame if the material is in the form of a fine powder. All of these are instances of a combination of oxygen with other materials.

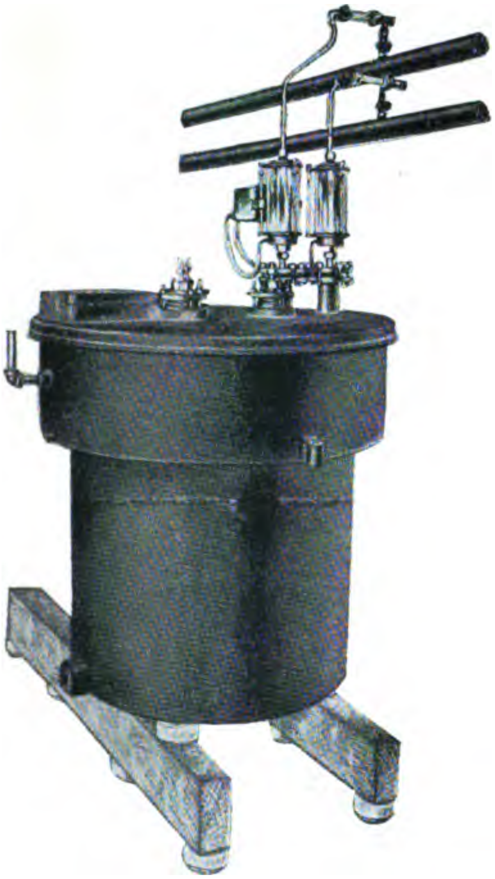
It is not generally appreciated that in our various forms of explosives we have combustion or recombustion of oxygen with other constituents and that in such materials we commonly distinguish between rapid combustion, explosion and detonation, all being different degrees of speed of oxidation. Explosive powders, for example, are so regulated as to give any desired rate of combustion to meet the projectile or gun requirements.

It has been shown that even at high temperatures the presence of a trace of moisture is necessary for free oxidation, and in absolutely dry oxygen even sulphur and phosphorus can be distilled and carbon made red hot without any combustion taking place. A jet of burning carbon monoxide is entirely extinguished when introduced into pure and absolutely dry oxygen, but the presence of the minutest trace of moisture is sufficient to restore the oxygen to its activity.

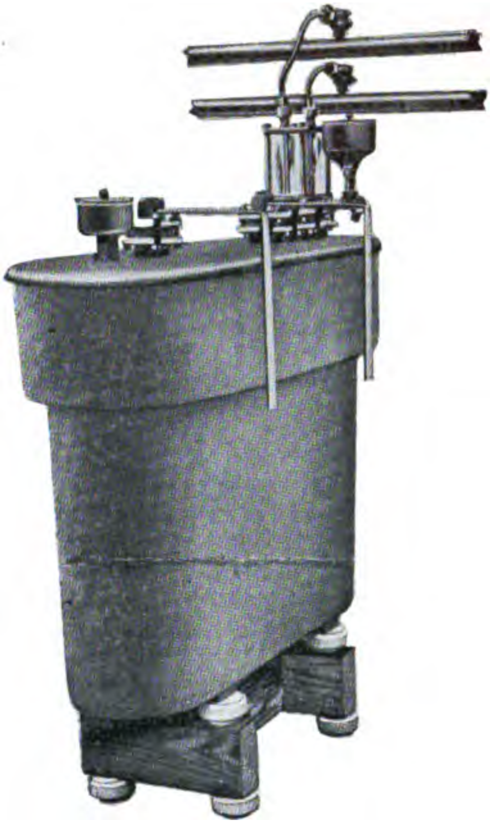
Manufacture.— The following methods have at various times been tried out commercially for the production of oxygen in quantity:

1. The ignition of nitre. The oxygen from this source was contaminated with oxides of nitrogen.
2. Heating manganese dioxide. (See p. 489). This was one of the cheapest of the early methods.
3. Heating a potassium chlorate-manganese dioxide mixture as described (p. 489). Until about 1885 this was the almost exclusive source of the considerable quantities of oxygen used for lime-light purposes.

A number of processes such as the following are now obsolete: extraction from air by utilizing solubility of oxygen in water; the alternate oxidation of cuprous chloride by air, the absorbed oxygen being recovered at dull red heat; alternate formation and decomposition (with liberation of oxygen) of alkaline manganates; heating a concentrated solution of bleaching powder at 70 to 80° C. with a cobalt catalyst, etc.

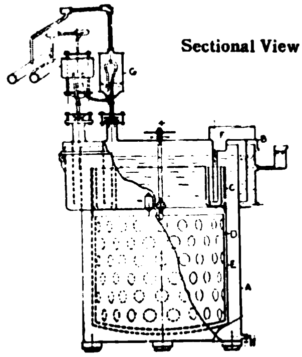


Single Unit Oxygen and Hydrogen Generator



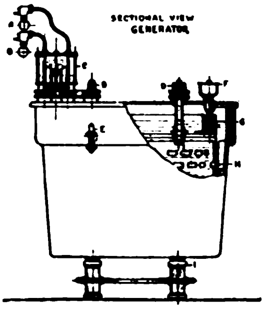
Single Unit Generator

Sectional View Generator



A—OUTER ELECTRODE
B—COVER
C—HYDRAULIC JOINT
D—INNER ELECTRODE
E—ASBESTOS SACK
F—FILLING HOLE IN COVER
G—LANTERN
H—PORCELAIN SUPPORTS

Fig. 1.—First electrolytic oxygen and hydrogen generator manufactured in United States (French Patents)



A. Oxygen offtake
B. Hydrogen offtake
C. Indicator and Pressure Equalizer
D. Positive electrode Terminals
E. Negative " "
F. Filling cup
G. Hydraulic Joint
H. Diaphragm
I. Insulating supports

DIMENSION OF GENERATORS

Height of cell 2' 10"
" over all 5' 6"
Length over all 3' 9"
Width " " 1' 9"
Weight empty 1000 lbs.
" full 1500 lbs.

Fig. 2.—First development of Fig. 1 with a view toward economy of floor space

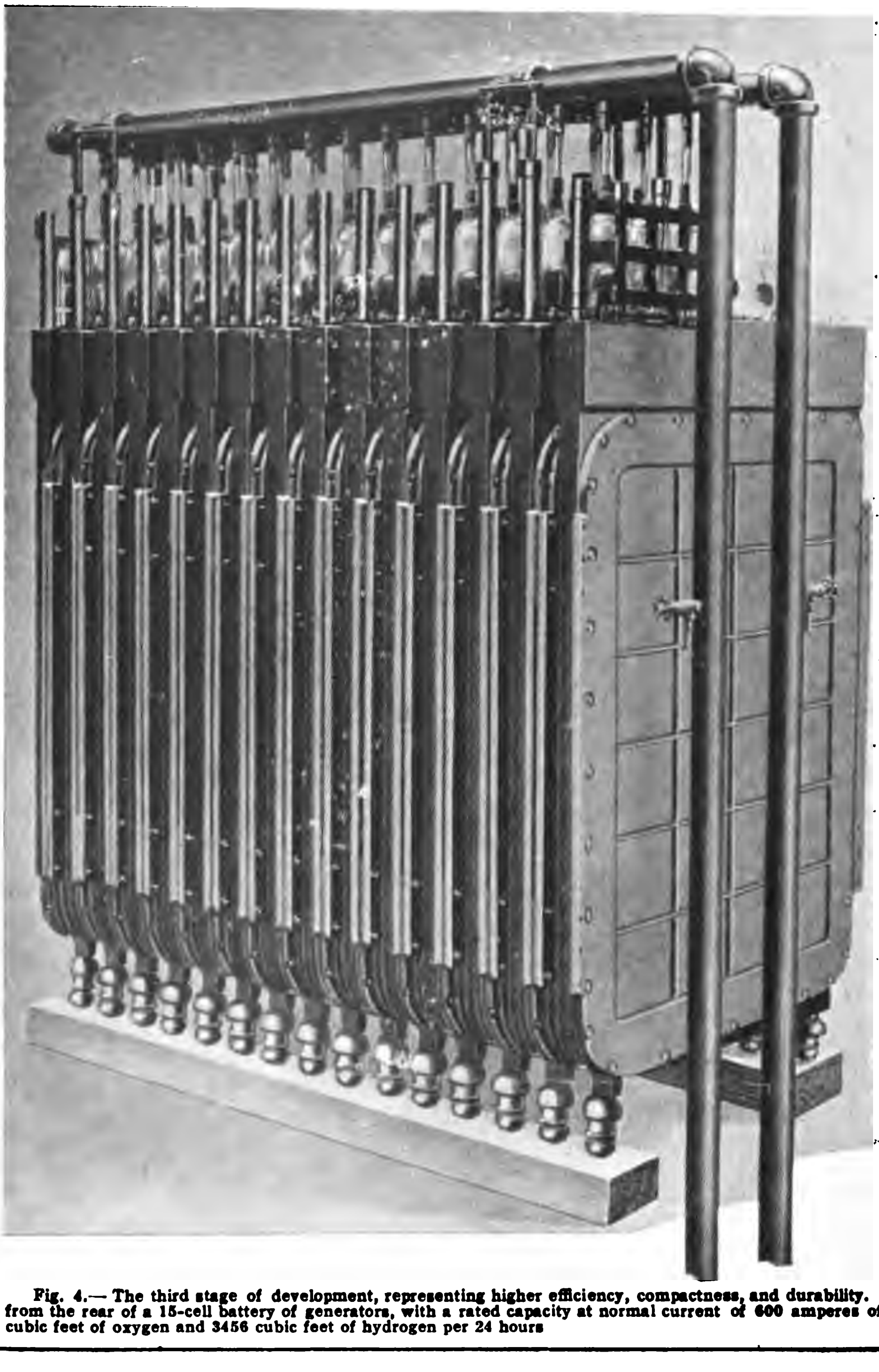


Fig. 4.— The third stage of development, representing higher efficiency, compactness, and durability. View from the rear of a 15-cell battery of generators, with a rated capacity at normal current of 600 amperes of 1728 cubic feet of oxygen and 3456 cubic feet of hydrogen per 24 hours

4. The alternate formation and decomposition of barium peroxide. Thorpe's ‘Dictionary of Applied Chemistry’ (1916) gives the following account of this process:

“In 1851 Boussingault found that when barium oxide (baryta) is heated to a dull-red heat in a current of air it is converted into barium peroxide, and that at a higher temperature this peroxide is again resolved into barium oxide and oxygen. But his attempts to utilize this reaction as a practical and economical source of oxygen failed owing to the fact that after a few oxidations and deoxidations the baryta lost its power of reabsorbing oxygen. Many other attempts were made to overcome this difficulty, but for long without success. In 1879, however, the MM. Brin frères were more successful, and took out a patent for the process (Eng. Pat. 1416 of 1880). Further improvements were made under the auspices of the company formed to develop and work the patents, and the process was made practical and economical and was worked on a large scale at various places.

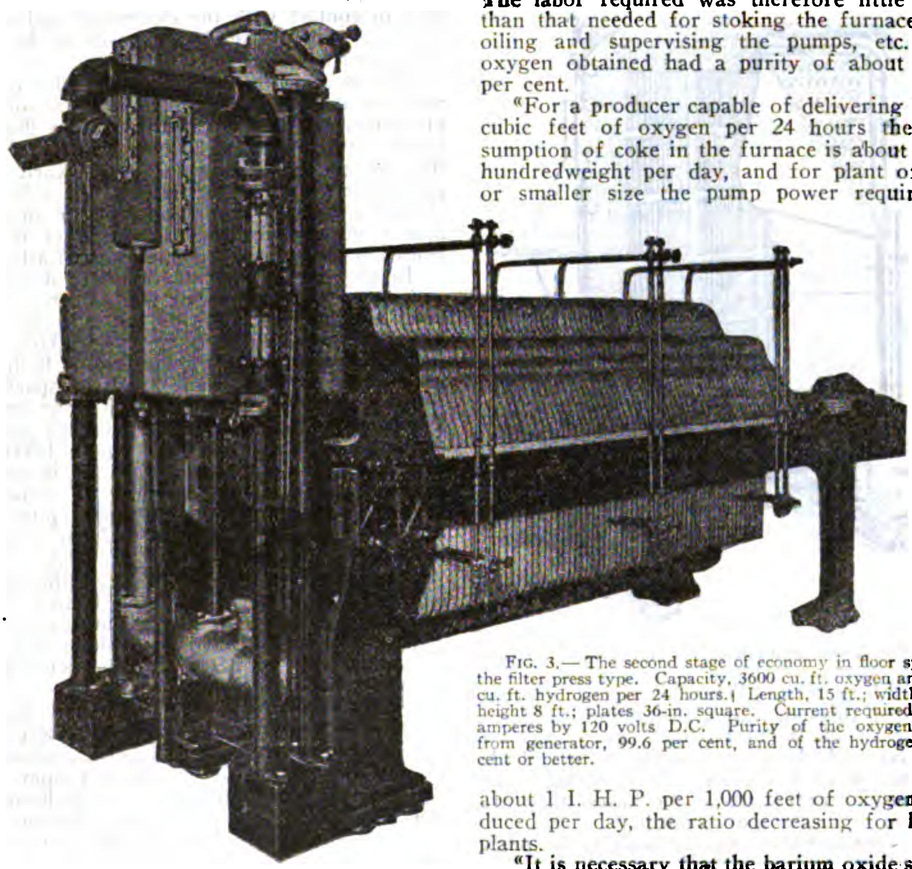


FIG. 3.— The second stage of economy in floor space — the filter press type. Capacity, 3600 cu. ft. oxygen and 7200 cu. ft. hydrogen per 24 hours. Length, 15 ft.; width 5 ft.; height 8 ft.; plates 36-in. square. Current required — 320 amperes by 120 volts D.C. Purity of the oxygen direct from generator, 99.6 per cent, and of the hydrogen 99.8 cent or better.

“The permanence of the baryta is mainly dependent on its physical condition, the use of reduced pressure during deoxidation, and consequent avoidance of excessively high temperatures, and the careful purification of the air used. It was found possible to dispense with change of temperature in the reaction, change of pressure being alone trusted to for determining the respective phases of oxidation and deoxidation. Neither the oxidation nor the deoxidation is as complete as when two temperatures are used, and the yield per operation is much less. But the duration of the operation was reduced from about 4 hours to 8–15 minutes, and the total daily yield therefore largely increased. At the same time the operation was much simplified, the wear and tear of furnace, retorts, etc., very greatly reduced, and the fuel required lessened. Labor was also economized, the multiplied reversals of cocks, etc., necessitated by the single-temperature method of working being effected automatically by reversing gear designed by K. S. Murray. The labor required was therefore little more than that needed for stoking the furnace, and oiling and supervising the pumps, etc. The oxygen obtained had a purity of about 93–96 per cent.

“For a producer capable of delivering 10,000 cubic feet of oxygen per 24 hours the consumption of coke in the furnace is about 12–15 hundredweight per day, and for plant of that or smaller size the pump power required is about 1 I. H. P. per 1,000 feet of oxygen produced per day, the ratio decreasing for larger plants.

“It is necessary that the barium oxide should be as hard and as porous as possible, and this is best obtained by preparing it by igniting the nitrate. The nitrate fuses and decomposition soon commences with evolution of a mixture of oxygen and oxides of nitrogen. This action continues for about two to three hours, during which time the contents of the crucible remain in ebullition. A porous mass is then left, which is heated for another hour to complete, as far as possible, the decomposition. In this way a very hard but also very porous baryta is obtained.

“This process was thoroughly practical and economical, and large numbers of plants were erected all over the world and worked successfully for many years. Some plants are still working, but in the last few years the process has been largely superseded by the still cheaper liquid air process, which also produces oxygen of greater purity.[5]

Commercial Manufacture.—The commercial manufacture of oxygen has thus reached the stage where oxygen in any appreciable amount is made either by the electrolytic method or by air liquefaction.

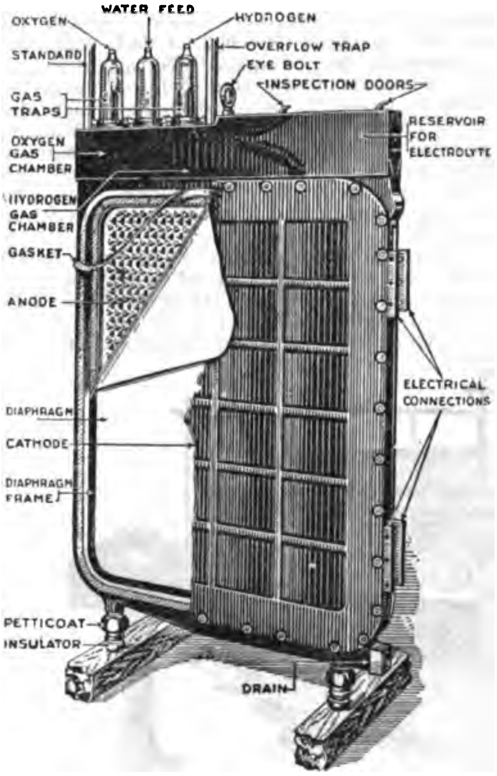


FIG. 5.— A section of one cell shown in bank of fifteen in Fig. 4.

By Electrolysis.— When an electric current is passed through water containing sulphuric acid or an alkali (to facilitate the passage of the current) hydrogen is formed at the cathode and oxygen at the anode. By providing suitable means for collecting the gases, they are obtained in a very pure condition.

This method lends itself readily to the preparation of hydrogen and oxygen for the laboratory or for larger industrial uses.

With each volume of oxygen two volumes of hydrogen are evolved.

For laboratory purposes the electrolyte may be dilute sulphuric acid and the electrodes of platinum.

For the commercial production of these gases the electrolytic cell is made as compact as possible; the electrolyte is a solution of caustic potash or caustic soda, and the electrodes are of cast iron (the anode being nickelplated to increase efficiency and to prevent rusting). A very efficient type of cell now on the market is shown in the accompanying cuts.

Essentially this consists of a thin rectangular box to which are bolted two cast-iron plates or electrodes. The cavity thus formed between the electrodes is divided by a diaphragm of asbestos fabric. In the upper part of the cast-iron frame are reservoirs for the electrolyte from which it is fed to the two sides of the diaphragm. The two gas chambers which permit the separation of the gas from moisture and electrolyte are also located in the upper part of the frame of the cell, and serve as gas traps and gas offtakes, as well as automatic pressure controlling devices. At the bottom of the frame are the communicating passageways which permit equalization of densities in the electrolyte. The inside of the electrodes carry a great number of pyramid-shaped projections which greatly increase the area in contact with the electrolyte and which facilitate the release of the gases at the generating surface.

The interior of the cell, both sides of the asbestos diaphragm, is filled with a solution of caustic potash or caustic soda in distilled water. When the electric current is passed through, the gases form and rise upward along the surfaces of the electrodes to the collecting chambers above. Any tendency for them to flow from one electrode to the other is prevented by the intervening diaphragm of asbestos.

In the special type of cell here described, with a normal current of 600 amperes at 2.2 volts and an electrolyte of caustic soda solution, a kilowatt-hour efficiency of 3.65 cubic feet of oxygen and 7.3 cubic feet of hydrogen is obtained. It has a normal rated capacity of 4.8 cubic feet of oxygen and 9.6 cubic feet of hydrogen per clock hour. This cell can be operated at current strengths up to 1,000 amperes, at which point the capacity is greatly increased though the efficiency is somewhat lower. The gases are extremely pure, the oxygen analyzing as high as 99.7 per cent and the hydrogen as high as 99.9 per cent.

The three prototypes of this cell, the first of which was introduced into the United States in 1910, are shown in the accompanying cuts. The improvements have been along the lines of compactness, higher electrical efficiency and simplicity of construction.

From Liquid Air.— By fractional distillation. Since the boiling point of oxygen at atmospheric pressure is — 182.7° C., while that of nitrogen is —195.5° C., by a proper fractionating apparatus the nitrogen in liquid air can be allowed to boil off first, leaving pure oxygen behind. See Liquefaction of Gases, p. 495.

Commercial Uses.— Because it costs nothing, the oxygen which plays so large a part in the burning of fuel for the production of light, heat and power, or wherever fuel of any kind is burned, is generally overlooked in listing the uses of oxygen. However, each ton of coal burned consumes about three tons (about 70,000 cubic feet) of oxygen. The amounts of oxygen consumed in this way are scarcely comprehensible. One moderate sized blast furnace uses 40,000 cubic feet of air per minute and since it is becoming possible to make oxygen cheaply the use of super-oxygenized air for blast furnaces is being seriously considered. Experiments made on a 100-ton furnace in Belgium before the World War showed that by increasing the percentage of oxygen in the air only from 21 to 23 per cent, a saving of over 100 pounds of coke is effected in smelting 1 ton of iron, and at the same time the output of the furnace is increased by from 10 to 15 per cent.

1. *For Welding and Cutting of Metals.*— Oxygen in conjunction with hydrogen or acetylene in the oxy-hydrogen or oxy-acetylene flame finds very extensive use for cutting all kinds of iron and steel even up to massive structures. The accompanying cut shows an oxy-hydrogen torch fed by oxygen and hydrogen from two steel cylinders containing the compressed gases. The oxygen is supplied to the inner and the hydrogen to the outer tube. The quantity of the two may be regulated at will so that an oxidizing or reducing flame is obtained. For cutting an oxidizing flame is employed. When the metal upon which the flame is directed has attained the desired temperature the hydrogen gas is shut off. The stream of oxygen plays upon the hot metal and combines with it to form Fe_3O_4 which is then blown away in the gas current. For autogenous welding a reducing flame must be employed. The cutting out of a manhole in a boiler of average size by mechanical means will employ two workmen seven to eight hours; by means of oxygen this can be done in about eight minutes. Similarly large steel boiler plates, rails, girders (e.g., in demolishing buildings), etc., may be cut away with extreme ease and nicety. Metals autogenously welded are frequently stronger at the welded portion than elsewhere. The above properties of the oxy-hydrogen and oxy-acetylene flame have found extensive application in the motor car industry, in railroad and boiler and machine shops, in mining and tunneling, also in the tinning and enameling industries.

2. *For Combustion.*— Air enriched with oxygen allows the smokeless combustion of certain fuels in furnaces; also for the production of producer and water gas. It is finding application as well for obtaining high furnace temperatures; e.g., in the glass industry, saving fuel and time.

3. *In Varnish Manufacture.*— Animal and vegetable oils, such as fish oil, linseed oil, soya bean oil, etc., may be oxidized by blowing with oxygen gas to form oils of much higher viscosity and specific gravity.

4. *Medicine.*— Oxygen is advantageously used in cases of asphyxia, asthma, autointoxication, pulmonary diseases, heart diseases, anæmia and diabetes. It has a cicatrising action in the cure of wounds and prurulent infections.

Oxygen in cylinders is used for freshening the air in submarines; for high altitude work in aeroplanes; for experimental and analytical work in laboratories; for medical purposes as noted above, for melting silicon and in the blowpipes used in the manufacture of synthetic gems.

The most important industrial use is for oxy-acetylene or oxy-hydrogen welding and cutting. Though a very recent development in the engineering and construction field, the amount of oxygen consumed in this way is enormous.

According to the *Engineering* (London) No. 98 for the year 1915, in 1911 Germany used 150,000,000 cubic feet of oxygen, France 100,000,000 cubic feet and England about 70,000,000 cubic feet. Of these amounts at least 90 per cent was used for welding and cutting metals. The same authority states that in 1915 there were some 50 liquid-air oxygen plants operating in Europe and that the British Oxygen Company had eight factories equipped in this way; at the same time there were only five such plants in the United States. The growth of the industry abroad is indicated by the figures given in an address delivered before the Royal Institution in London, on 17 Jan. 1919, by Sir James Dewar. It was stated that in Great Britain the total output of the 12 factories then manufacturing liquid oxygen was 118 tons per day, 85 per cent of which was used for cutting and welding purposes and 15 per cent for medical purposes; and that in Germany one plant alone was turning out 100 tons per day.

At the present writing there are oxygen plants in every industrial region in the United States. Each of the two large companies operating liquefaction processes now produces more pure oxygen than was produced in the entire world prior to a few years ago.

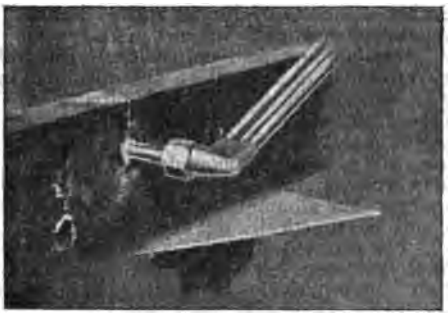


FIG. 6.— An oxygen-hydrogen cutting torch in operation.

The oxy-acetylene and oxy-hydrogen welding and cutting process have revolutionized the steel and construction industries. Hundreds of thousands of tons of steel scrap, formerly too heavy for handling, now are cut easily into convenient sizes for remelting. Many machines formerly rendered useless by breakage now can be repaired quickly, and many high-grade castings now can be reclaimed, instead of being remelted. Cutting and welding torches, in consequence, are to-day an indispensible part of the equipment of factories, scrap yards and machine shops.

Bibliography.— Thorpe, 'Dictionary of Applied Chemistry'; Martin, G. F., 'Industrial Gases'; Claude, C., 'Liquid Air'; Miller, S. W., 'Oxy-Acetylene Welding'; Ellis, Carleton, 'Hydrogenation of Oils — Catalysis — Generation of Hydrogen and Oxygen.'

OZONE, a colorless gas, an allotropic form of oxygen, having a peculiar odor like that of chlorine and extreme chemical activity. Its density is one and one-half times that of oxygen and it is changed into oxygen only at a high temperature. Ozone is found in country atmosphere to a much greater extent than in cities and towns, and on mountain tops to a greater extent than in deep valleys. Its molecular formula is O_3 and its molecular weight, 48.00.

The peculiar odor around an electrostatic machine in operation was noticed long before its cause was discovered. In 1840 Schonbein explained the cause of this phenomenon and succeeded in preparing ozone by the electrolysis of water and by the slow combustion of phosphorus.

Physical Properties.— 1. Ozonized air is colorless and has an odor somewhat similar to that of chlorine. It exerts a stimulating action on the salivary glands. Pure ozone (obtained by liquefaction) is bluish in color and dangerous to handle on account of its tendency to explosive decomposition. Like oxygen, ozone is a supporter of combustion.

2. Specific gravity, 1.658 (air = 1). Boiling point, — 119° C. Decomposing temperature, 270° C. Solubility in water per 100 volumes, 0.88 volume. Ozone dissolves in and combines with the etheral oils, especially turpentine, cinnamon oil and with aqueous quinine solutions.

Chemical Properties.— 1. The formation of ozone is an endothermic reaction, the heat of formation being 36,208 calories.

2. Ozone is a powerful oxidizing agent. It bleaches solutions of litmus and of indigo. It oxidizes phosphorus, sulphur and arsenic to the corresponding acid anhydrides. Sulphides are converted to sulphates; and nitrogen into N_2O_5, ammonium nitrate, and nitrite, in the presence of water. Manganese in solution is quantitatively precipitated as MnO_2. It attacks almost all organic compounds and rapidly corrodes rubber tubing, and cork or rubber stoppers. The albuminoids and saturated hydrocarbons are practically unaffected.

3. Unsaturated organic compounds with a double bond between carbon and carbon absorb ozone quantitatively forming characteristic *ozonides*.

4. Ozone is a strong bactericidal agent.

Laboratory Methods of Preparation.— 1. *Electrolysis.*— Fisher and Massanez (1907) obtained oxygen containing 23 to 28 per cent of ozone by electrolyzing between cooled platinum electrodes dilute sulphuric acid (specific gravity 1.223 to 1.07) by a current of 80 amperes per square centimeter at 7.8 volts. They obtained a yield of 7.2 grams ozone per kilowatt hour.

2. *Thermal Method.*— As stated above, the formation of ozone is an endothermic reaction. Nernst has shown that free atoms of oxygen form ozone only when their concentration is 10 to 20 times greater than in ordinary oxygen. Therefore ordinary oxygen should be readily transformed into ozone when exposed to high temperatures and pressure. To minimize the decomposing effect of the high temperature on the ozone the air must be rapidly cooled after exposure to heat.

A current of dry air is brought in contact with an electrically heated Nernst filament. Better results, however, are obtained by immersing the incandescent filament in liquid oxygen. (German patent 195, 985; 1906).

3. *By Ultra-Violet Rays.*— A current of air is subjected to the influence of the rays from a mercury vapor lamp. The lamp has a bulb of quartz (transparent to ultraviolet rays) and the air is passed spirally between the bulb and an outer wall of glass (fairly impervious to the ultraviolet rays). (United States patent 845,965).

Commercial Methods of Manufacturing Ozone.— Of the methods which have been tried for making ozone, the only practical ones have been those involving the passage of air or oxygen through an apparatus and subjecting it to the influence of the silent electrical discharge. A very good ozonizer is the Siemens and Halske machine. Each ozone tube (of which there are six or eight set in a suitable metal tank through which water flows for cooling purposes) consists of a cylinder of glass around one of aluminum. The aluminum cylinders are connected to the alternating current, the glass being grounded by contact with the cooling water in the tank. Air enters a lower chamber beneath the cooling tank, passes through the ozone tubes, where it is subjected to the influence of a silent electrical discharge, and passes off as ozonized air from an upper chamber. The tension of the current will vary between 10,000 and 90,000 volts at, at least, 100 alternations per second. A higher tension yields a greater output of ozone. The Siemens-Halske ozonizers yield about 60 grams of ozone per horse-power hour. For further details regarding this machine and several other modifications, consult Martin, 'Industrial Gases.'

Uses of Ozone.—(1) Ozone finds some application in the bleaching of sponges and straw. (2) The principal use of ozone depends upon its bactericidal property. It is used for sterilizing water, as well as air. The advantage in the use of ozone for purifying water lies in the fact that it is non-toxic and leaves no objectionable residue. Furthermore it does not attack the salts usually found in water which give it its characteristic taste. (3) The disagreeable effects of air in crowded rooms are not entirely produced by the excess of carbon dioxide present. They are partly due to organic substances given off from the skin and lungs of the people present. The introduction of a slight amount of ozone into such rooms is found to offset the bad effects by oxidizing these impurities. However, the bacteria present in such crowded rooms cannot be destroyed by the amount of ozone permissible, for the concentration required to kill bacteria would be such as to make the air intolerable to those present. (4) Ozone has recently found application in the commercial manufacture of vanallin from iso-eugenol and in the production of artificial camphor. Consult Martin, 'Industrial Gases'; Thorpe, 'Dictionary of Applied Chemistry'; Vosmaer, Alexander, 'Ozone, Its Manufacture, Properties and Uses' (New York 1916).

SULPHUR DIOXIDE. Sulphur dioxide (SO_2) is found free in considerable quantities in Nature, in certain volcanic emanations, and being an exothermic compound it is readily formed together with a trace of SO_3 by burning sulphur in the air: $S + O_2 = SO_2 + 71.6$ cals., and 1 kilo of sulphur develops 2,165 cals. on burning. The formation of SO_2 by burning solid sulphur occurs without change of volume, that is, from one volume of O_2 one volume of SO_2 is obtained, and from this its composition may also be deduced, because if SO_3 were to be formed then from three volumes of O_2 one would obtain two volumes of SO_3. Sulphur dioxide is manufactured industrially by roasting certain metallic sulphides, especially pyrites (sulphides of iron, copper, etc.), in special furnaces: $CuS + 110 = CuO + SO_2$ and also:

$$2FeS_2 + 110 = Fe_2O_3 + 4SO_2 + 419.8 \text{ cals.},$$

that is, 105 cals. for each molecule of SO_2.

The SO_2 from large copper smelting plants is sometimes utilized for the manufacture of sulphuric acid in lead chambers, but cannot be used for the manufacture of catalytic sulphuric acid, because the catalyst soon becomes covered by powdered zinc oxide and the excessive amount of moisture renders the acid very dilute. Liquefied sulphur dioxide is now a regular article of commerce and it is generally transported in steel cylinders or flasks, holding approximately 100 kilos. It is also shipped in small cylinders holding about 10 pounds for use in laboratories and medical institutions. Within late years sulphur dioxide has been used quite extensively in the manufacture of ice, particularly in small ice machines manufactured for domestic purposes. This substance is also used extensively as a reducing agent, a bleaching agent, a disinfectant and as a fire extinguisher. Sulphur dioxide is a dry, colorless gas of suffocating, disagreeable and penetrating smell; it gives white fumes in moist air; it is harmful to respiration and to vegetation. It is readily liquefied when cooled with ice and salt at a pressure of three atmospheres. In the liquid state it has a specific gravity of 1.53 at 0° F., boils at —8°, and solidifies at —76°.

History.— Sulphur dioxide was first liquefied by Monge in Clouet about the beginning of the 19th century. In 1878 R. Pictet prepared liquid sulphur dioxide for his ice machines by allowing a continuous stream of strong sulphuric acid to pass on to molten sulphur, which was placed in a cast-iron retort heated to 400°. $2H_2SO_4 + S = 3SO_2 + 2H_2O$. Regular development of SO_2 may be obtained in the laboratory by heating one part of mercury or of copper turnings with three parts of strong sulphuric acid in a flask.

$$Cu + 2SO_4H_2 = CuSO_4 + 2H_2O + SO_2.$$

Commercial Methods of Manufacture.— The general method of commercial manufacture of sulphur dioxide is in accordance with the Hanisch and Schroeder patent, dated 1883 and perfected later (German Patent 52,025 of 1889). Briefly this method consists of the burning of pure brimstone in a suitable furnace, the very hot gases from the burner passing through a suitable cooling apparatus and thence to an absorption tower where the SO_2 gases only are absorbed by cold water which flows to a digester where the solution is heated sufficiently to drive off the SO_2 gases, which after passing through drying chambers is compressed into a liquid. One of the functions of the absorption tower just mentioned is to release from the SO_2 gases any nitrogen or oxygen which escapes from the top of the tower.

Commercial Uses of Gases.— Formally most of the sulphur dioxide produced was used directly on the spot for the manufacture of sulphuric acid. However, its uses are now varied and greatly extended, and a considerable market is found for it for use in wood pulp factories, paper mills, sugar refineries, bleaching and dye works, ice manufacturing plants, chemical and metallurgical processes, as well as a disinfectant and fire extinguisher. New fields are constantly appearing where it is found that sulphur dioxide can be used to great advantage. A unique use to which it is occasionally put is to freeze and solidify moist soil around coffer-dams where it is impossible to keep out the water by ordinary piling or sheathing methods.

Medicinal Uses.— Very recently it has been shown by medicinal men that sulphur dioxide when properly handled is of great value in staying the action of tubercular affection. This opens a very interesting field for the use of this substance, and without doubt other uses, in a medicinal way, will be found for it. As a powerful disinfectant the effects of sulphur dioxide gas are well known.

The manufacture and use of Sulphur Dioxide is described at length in Molinari's 'Industrial Chemistry' as well as in various books by Lunge, which treat on sulphuric acid and alkali.

LIQUEFACTION OF GASES. It has been long known that most solids can be transformed into liquids by the application of heat, and that many liquids can also be transformed into vapor by a further addition of heat. Conversely, it was known that certain aeriform substances, such as steam, can be converted into liquids by the mere abstraction of heat. It was believed, however, that an essential difference existed between gases and vapors, vapors being condensible to the liquid form, while gases were believed to be permanently aeriform, and not condensible.

In the early part of the 19th century the validity of this distinction came to be doubted, and Faraday, at the suggestion of Davy, undertook the systematic study of the question. He succeeded in reducing to the liquid form quite a number of gases that had previously resisted liquefaction. His general method consisted in generating the gas in large quantities in a limited space, so as to produce a very high pressure, under the influence of which (when the experiment was successful) the gas passed into the liquid state. The most convenient way of carrying out this experiment is to make use of an inverted V-shaped glass tube, one of whose legs contains a chemical preparation suitable for the generation of the gas in question, while the other end dips into a freezing mixture, the tube being hermetically sealed. If cyanide of mercury be heated in one of the legs of a tube of this kind, for example, cyanogen gas is generated in such quantities that the pressure causes a large part of it to condense in the chilled end of the tube.

Chlorine was liquefied by Faraday in this manner in 1823. Shortly afterward Thilorier succeeded in liquefying and solidifying carbon dioxide by the combined application of intense cold and great pressure; Cagniard de la Tour, Regnault, Natterer and many other experimenters improved the methods in use, with the result that many of the gases that had been previously regarded as non-condensible were reduced to the liquid form. Oxygen, hydrogen, nitrogen and some few other gases still resisted all attempts at liquefaction, however, and these were still called «permanent gases,» although the conviction had forced itself upon physicists that all gases could be conquered if the necessary conditions could be discovered. The subject was in this state when Andrews undertook his classical study of the phenomena of liquefaction of carbon dioxide. In 1863 he made the following announcement: «On partially liquefying carbonic acid by pressure alone, and at the same time gradually raising the temperature to 31° C. the surface of demarcation between the liquid and gas became fainter, lost its curvature, and at last disappeared. The space was then occupied by a homogeneous fluid which exhibited, when the pressure was suddenly diminished or the temperature slightly lowered, a peculiar appearance of moving or flickering striae throughout its entire mass. At temperatures above 31° C. no apparent liquefaction of carbonic acid, or separation into two distinct forms of matter, could be effected, even when a pressure of 300 or 400 atmospheres was applied.» It appeared, therefore, that a certain temperature exists above which carbon dioxide cannot be liquefied by any pressure whatever and this discovery was soon verified in the cases of other gases. It was apparent, therefore, that for each gas there is a temperature above which it cannot be liquefied by any pressure. This temperature is known as the «critical temperature,» and the pressure necessary to bring about liquefaction at the critical temperature is called the «critical pressure.» The reason that oxygen, nitrogen and hydrogen had resisted previous attempts at liquefaction, even when the pressure was increased to 3,000 atmospheres, was that the critical temperatures of these gases are very low indeed — far below any temperature at which attempts at liquefaction had been made. The problem of liquefying the so-called «permanent gases» was then resolved into the production of exceedingly low temperatures.

Methods of Production.— The methods in use for the production of low temperatures are as follows:

1. *Freezing Mixtures.*— The most common freezing mixture, ice and salt, produces when mixed in suitable proportions (1 part salt to 3 parts ice) a temperature of —23° C. In 1834 Thilorier found that by mixing solid carbon dioxide with ordinary ether he could obtain a temperature as low as —110° C. This «Thilorier's Mixture» was for a long time the only means available for securing very low temperatures.

2. *Evaporation.*— The first use of this method of cooling was in 1824 by Bussy, who found that he could get a temperature as low as —65° C. by rapidly evaporating liquid sulphur dioxide. By this means he liquefied chlorine, ammonia and even solidified cyanogen. This method of refrigeration is still in use. Subsequent to Bussy's experiments it was soon learned that both carbon dioxide (CO_2) and ammonia (NH_3) are well adapted to liquefaction with subsequent evaporation to produce low temperatures. These two gases are in common use in our present-day refrigerating systems, carbon dioxide being preferred where leaks due to accident would make the ammonia system undesirable or even hazardous, as, for instance, on board ship.

3. *Expansion* (without external work).— The first practical use of the fact that a gas undergoes a drop in temperature when allowed to expand through a small orifice, ***without doing external work,*** was made by Thilorier in 1834, when he liquefied and solidified carbon dioxide by this method.

In 1799 Van Marum observed that at high pressures ammonia gas does not obey Boyle's Law (i.e., that the product of the pressure and volume of a gas is a constant quantity). An extended series of tests by Amagat, extending up until 1888, has shown that the same is true of practically all gases, i.e., under high pressures, the volumes of all gases (except hydrogen, helium and neon at comparatively high temperatures) are less than those calculated by the gas laws, due to the tendency of the gas molecules to cohere as the approach is made to the liquid state. A «perfect» gas expanding into a vacuum should undergo no fall in temperature, since it would do no work, but ordinary gases do become cooled.

The work they do in expanding thus consists in overcoming the cohesion between their molecules, so that a tearing apart of the substance occurs and this consumes heat; this action takes place so quickly that there is no time to absorb heat from surrounding materials, and as a result the gas itself is cooled. Since the cohesion of the molecules becomes more marked as the temperature approaches the liquefaction point of the gas, the cooling effect of expansion becomes also greater as the temperature falls.

The heat lost by the expansion of non-ideal gases was investigated in 1854 by Joule and Thomson. The cooling of gases in this way is known as the Joule-Thomson effect, and it holds good for all gases except hydrogen (helium and neon) which above —80° C. is warmed by expansion.

The Linde apparatus (1898) for the liquefaction of air depends on the Joule-Thomson effect. In this apparatus the gas under 200 atmospheres pressure is precooled by an ordinary refrigeration machine and introduced into the actual liquefying column, where it is allowed to expand through an orifice without performing external work; the gas, cooled thus, is used to cool more incoming gas which in turn expands through the orifice and becomes further cooled; thus the temperature falls lower and lower until the liquefaction point of the gas in question is reached. Suitable arrangements are made for withdrawing the liquid as desired, or, in the case of air liquefaction, for submitting the liquid mixture to fractional distillation, by which method oxygen, nitrogen, argon, etc., may be obtained. Obviously, hydrogen cannot be liquefied in such an apparatus unless previously cooled lower than —80° C., as was shown by Dewar, Ramsay, Olszewski and others.

4. *Heat Exchanger.*— The so-called «Regenerative Method» of cooling refers merely to the use of a gas cooled by expansion to further cool more incoming gas, thus obtaining further decreases in temperature. This method was

first used in 1857 by Siemons and was applied to liquefaction of gases at the suggestion of Houston in 1874. This principle is embodied in all the liquefaction processes, the arrangement being known as a «heat-exchanger,» a series of concentric tubes in which the less cool gas passes along the inner tube counter current to the cooler gas as it flows in the surrounding outer tube. So efficient are well-constructed heat exchangers that in manufacturing liquid air there is a difference of only 3 or 4° C. between the temperatures of the entering air and the escaping gases; i.e., during the passage of a few seconds through the exchanger, the escaping air is heated from —190° C. to nearly room temperature. Obviously the manufacture of liquid air owes much of its success to the «heat-exchanger.»

5. *Expansion* (with external work).— In this case an expansion engine is inserted in the circuit of a liquefaction system so that the gas expanding through the small valve (orifice) may do external work and thereby lower the temperature more than can be accomplished by mere expansion without external work. This principle was applied commercially by Claude and his work has made possible an industry that has expanded until at the present time liquefaction machines based on the Claude system are located in all parts of the world for the production of oxygen and nitrogen from atmospheric air.

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ROBERT N. KING,
New York City.

LIQUEUR, li-kėr′ (the French name), a palatable spirituous drink composed of water, alcohol, sugar and some aromatic infusion extracted from fruits, seeds, etc. The great differences in the qualities of the different liqueurs are due principally to a variation in the proportions of the sugar and alcohol. The French distinguish three qualities: the *ratafias*, or simple liqueurs, the oils, or the fine liqueurs, and the cream or superfine liqueurs. Consult Mew and Ashton, 'Drinks of the World' (1892).

LIQUID AIR. See AIR; LIQUEFIED AND COMPRESSED GASES.

LIQUID-AMBAR, lĭk′wĭd-ăm″bar, **SWEET, RED**, or **STAR-LEAVED GUM**, a tree (*Liquidambar styraciflua*), also called bilsted and alligator-tree, of the witch hazel family, widely diffused through North America, from lat. 43° to Florida, and along the shores of the Gulf into the provinces of Mexico. The leaves are five-lobed, and the lobes are pointed, and serrated on the margin, giving them a very distinct and elegant form, and in autumn they turn rich purplish red. The flowers are inconspicuous. The fruit consists of a hanging ball of woody pointed pods which open and release the seeds,— a most singular fruit, suggesting the globular spiked head of the mediæval war-club called «morning star.»

LIQUID FIRE. The «flammenwerfer» or «flame thrower» was first employed by the Germans in the European War, 1914–18. It resembles a fire extinguisher and is hung on the back of the soldier while an extension that is held in the hands throws the flames. The cylinder contains oil and compressed gas. As the oil is forced out of the cylinder by the compressed gas it catches fire and spreads out in a sheet of flame and smoke. A single «flammenwerfer» can cover a frontage of about six yards when stationary and the flame burns for about one minute. The extreme range is about 300 yards and the kind of oil used depends upon the atmosphere. The discharge is accompanied by a loud roar, yellowish-red flames and a dense black smoke, making it very difficult for green troops to realize that it is effective for such a short distance. While the heat of the flames is intense the burning takes place entirely in the air and the stream cannot be turned downward as the heat causes an upward current. Protection is easily obtained by any non-inflammable cover above and a soldier is safe if kneeling on a fire step or just within the entrance of a dug-out. There are two principal kinds or sizes of «flammenwerfer» — the smaller size being carried by one man. The iron container is usually three feet long by one and a half feet wide, with two hooks for the body and the mixture is of heavy and light oil plus gasoline. The combustible used in the flame throwers has varied in source and composition from time to time, but it has one characteristic which is essential for good results — it must have light or easily volatile and heavy and less volatile fractions mixed in carefully graded proportions. The heavy oil is usually a petroleum product or a tarry residual oil from the distillation of wood. The light portion, which ensures the jet's keeping alight, was originally a light gasoline. The lighting device, fixed at the end of the flexible hose, is the most ingenious part of the contrivance and is so made that the oil ignites spontaneously the minute the jet is turned on, and is kept alight by a fiercely burning mixture which lasts throughout the discharge. The nozzle is about nine inches long and detachable so that replacement is easy.

LIQUOR LEGISLATION. The excessive use of intoxicating liquors has been, in all ages of human history down to our own times, a serious problem for those charged with the government of tribes or nations. For thousands of years legislators have endeavored with more or less success to control the use of and traffic in drink. The early Mosaic lawgivers attempted to repress drunkenness, and over 2,000 years B.C. King Hammurabi of Babylon ordained that a wine-seller who permitted riotous persons to assemble on his premises should be put to death. There seems to be no example of a people, however primitive or civilized, without drink or drugs of some kind, whether wine, beer, spirits, opium, hashish, hemp, betel nut, tobacco, coffee, kava, etc. With the growth of population and expansion of communities into great states during the last two centuries there has arisen an elaborate code of laws in most countries to restrict and control the liquor traffic. Despite the ever-increasing burden of taxation laid upon intoxicating drinks, their sale and consumption rose steadily. In the United States, the first laws aiming at prohibition of the manufacture and sale of liquors date back to 1838 (Tennessee) and 1846 (Maine). For many years a strenuous campaign raged between the «wet» and «dry» partisans, the one side claiming an inalienable right of the people to decide for themselves what they shall drink and the other pointing to the social and economic evils produced through drink.

The entry of the United States into the European War was destined to produce the most revolutionary changes in liquor legislation recorded in American history. Up to that time the liquor laws differed considerably in the 48 States of the Union, each of which exercised its own police laws within its borders. In some States «local option» prevailed, by which popular vote decided whether liquor should be sold in prescribed districts; other States were «dry,» «bone-dry» or «wet.» Persons desiring to deal in liquors required a license from the State authorities, for which an annual fee (in some cases as high as $1,500) was charged. Prospective dealers were generally required to produce credentials of good character; in some cases written consent of the neighboring residents was necessary, while in others certain restrictions were imposed as to distances from churches, schools and similar institutions, Sunday and Election Day closing, etc.

On 1 Jan. 1917 prohibition was in force in 19 States; on 1 July, when the Reed Amendment came into effect, there were 23 «bone-dry» States. That Amendment, introduced by Senator Reed of Missouri, imposed a fine of $1,000 or imprisonment for six months or both on «who shall order, purchase, or cause intoxicating liquors to be transported in interstate commerce except for scientific, sacramental, medicinal, or mechanical purposes into any State or Territory the laws of which . . . prohibit the manufacture or sale therein of intoxicating liquors for beverage purposes.» The same penalties were prescribed for violators of the anti-advertising section. This measure was followed by the Food Control Act, under the provisions of which the distillation of alcoholic beverages from grain and other foodstuffs, fruits included, was prohibited for the duration of the war as from 11 P.M. on 8 Sept. 1917. On 21 Nov. 1918 President Wilson signed the Food Stimulation Bill, providing for nation-wide prohibition from 30 June 1919 until the demobilization of the army. See PROHIBITION.

In Great Britain the liquor laws are strict and complicated. For nearly 400 years successive Parliaments have struggled with the drink problem, though prohibition has never been seriously contemplated. Beer is the principal beverage; the per capita consumption in 1913 was 26.2 gallons, as against 20.62 for the United States and 22.0 for Germany. The per capita consumption of spirits is about half that of the United States. Licenses are distinguished as «full» or «on» license, «off» license (not to be consumed on the premises of sale) and «ale and beer license.» In pre-war times the closing hours for public-houses (strictly enforced) were 12.30 A.M. and midnight on Saturday in London; 11 P.M. in the provinces. On Sundays (in England and Wales) opening hours were from 1 to 3 P.M. and 6 to 11 P.M. In Scotland all public-houses are closed Sundays. Since 1905 there has been in operation a government scheme of reducing licensed premises, the owners being compensated from a fund created out of the revenue. During the 11 years 1905–15 a total of £9,326,589 ($46,632,945) was paid in compensation for 10,146 extinguished licenses, an average of roughly $4,596 each. For nearly 20 years attempts have been made in Great Britain to bring public-houses under public management by means of Public-House Trust Companies, with the object of eliminating as far as possible the element of private profit from the retail sale of drink. The manager who is put into the house receives a fixed salary and is allowed no profit whatever on the sale of alcoholic drinks. This movement, originated by the bishop of Chester and the late Earl Grey, now operates over 300 houses on this plan. During the war a number of restrictions were laid upon the drink trade; hours were curtailed, «treating» prohibited and numerous licensed places were closed by naval and military authority. Advisory committees were appointed by government to consider the question of the State purchase of the licensed liquor trade. The proposal was not considered practicable. In January 1919 some of the regulations were relaxed and government sanctioned the brewing of 25 per cent more beer and of a better quality than the standard to which it had deteriorated owing to war conditions.

On the European continent, liquor legislation was not of a drastic nature before the war. In France, licenses were cheap and easily obtainable. There was estimated to be a wine-shop for every 40 of the population. As in Germany, saloons were open at all hours of the night. In Russia, the government took over the vodka traffic in 1894 and made it a complete government monopoly. During the next 20 years the consumption of liquors rose over 500 per cent. In September 1914 the sale of all spirits was prohibited by imperial ukase. Shortly afterward the sale of vodka was prohibited «for ever» in Russia, yet that industry is to-day as flourishing as ever. Boys and girls began to drink spirits while yet at school, between the ages of 8 and 13. Under the old régime several legislative experiments were made to lessen the drink evil, though with small result. In Belgium and Holland, mild legislation and cheapness of alcohol were responsible for enormous annual drink bills. In Italy and the Balkans, as in France, the profusion of vineyards makes wine the principal beverage. The cheaper kinds are but lightly taxed and restrictions were practically non-existent. Local option obtains in Sweden and Norway. Early in the 19th century every farmer and peasant in Sweden was permitted to manufacture brandy for a small license fee. Brandy became so cheap, abundant and readily procurable that an epidemic of intoxication swept over the country. Vain attempts were made to check that by penalties on drunkenness and limitation of production. What came to be known as the Gothenburg system (q.v.) originated in Sweden and is to-day largely practised in Scandinavia. In the self-governing British dominions local option generally prevails. According to the *China Medical Journal* of July 1918, "there is a general impression that the suppression of the opium traffic is leading to an increased consumption of alcohol." Liquor legislation has existed in China for thousands of years, one ancient ordinance forbidding more than three persons drinking together without special cause and license. In 1918 distilleries and breweries were spread all over China, in addition to which the farmers manufactured large quantities of alcoholic liquors for home consumption.

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LIQUOR AND THE LIQUOR TRAFFIC. The term liquor is applied to alcoholic or spirituous fluids whether distilled or fermented. The first of these include wine and liquor made from the juice of fruits and in which the natural sugar is converted into alcohol by exposure to the open air. The second class includes beer, ale and porter, in which the starchy ingredients are by certain processes changed into sugar before fermentation can take place. The third division includes brandy, whisky, rum and gin, and whether these be derived from fruits or grain, the distillation process is carried on further by condensation and vaporization.

Wines.— France and Italy are the two greatest wine-producing countries in the world. The former is noted for the two distinct varieties of red wine, claret and Burgundy, and two varieties of white wines, Chablis and Sauternes, all healthful and innocuous beverages. The finest sparkling wine, champagne, also comes from France, and is not permitted (since 1910) to be shipped abroad under the name of "champagne" unless it was produced within the two topographical districts delimitated by the government — those of the Rivière, facing the river Marne, and those of the Montagne de Reims, which include a number of famous vineyards. The Italian soil and climate are admirably suited to viticulture; prodigious quantities of grapes are produced with but little care or attention. Sparkling wines are made on the low hills of the Azti and Montferrat region, while dry red wines are largely produced in Tuscany. The island of Capri yields some excellent white wines; the white Muscat wines of Vesuvius and the red Lacrima Christi are grown in the Neapolitan district. Algeria produces some fine natural and wholesome wine, which is shipped principally to France. Hungary is famous for the celebrated Tokay wine, while Austria, Switzerland, the Balkan states, Greece, Turkey and many of the Mediterranean islands boast extensive vineyards. Spain is noted for its sherry and Tarragona. The three principal classes of sherry are the Fino, a pale, delicate wine, the Amontillado and the Oloroso, a full dark wine. In Germany the vine can only flourish within a restricted area of the south and west. The "hocks" and "moselles" of Germany were used in England under the Saxon kings — a trade that existed till 1914. The famous port of Portugal enjoys a large export trade. Vermouth, of which there are two types, Italian and French, is a beverage with a basis of aromatized white wine. That of the Italians was written about by Cicero; it is made from a matured muscatel wine, sweetened with sugar and tinctured with a variety of herbs. The French variety differs on account of its basis being very "dry" white wine. Algeria has become a valuable vineyard within the last 40 years, and produces a wholesome, natural wine which is largely sent to France for local consumption. Wine has been made in South Africa since the introduction of the vine into the Cape in 1653. The best Cape wine is Constantia, made at the government wine farms near Cape Town. Other brands are produced and exported. The famous Malmsey wine of old came from Crete between 1204 and 1645 while the Venetians held the island. After its conquest by the Turks in 1669 the export ceased, and the somewhat similar wines of Greece, Cyprus and other eastern Mediterranean islands were sold in England as Malmsey. During the 18th and 19th centuries, however, the wine that bore the closest resemblance to the original was raised in Madeira, whither the true Malmsey grape of Candia had been introduced by the Infante Dom Henrique some three centuries before. Sicily is famous for the generous wines of Marsala, a fortified white wine, vatted and blended in much the same way as sherry. The two firms which control that industry were founded by two Englishmen. Despite handicaps of soil and climate, Australia has grown into a considerable wine-producing territory.

On the American continents vineyards flourish and vines are grown in the United States, both east and west of the Rockies, in Canada, Chile, Peru, Mexico, Argentina, Brazil, Uruguay and Bolivia. The early Spanish missionaries who settled in California found the wild vine growing in profusion, and devoted much time and labor to the cultivation both of the native species and the cuttings which they from time to time imported from European stocks. Owing to the attraction of the gold mines viticulture received but scant attention until 1875, when a viticultural commission was appointed for the purpose of encouraging the wine-making industry of that country. A State board of viticulture was created in 1880 to carry on the development. In 1887 the output of Californian wine was 4,000,000 gallons; 16 years from the creation of the board it had risen to 18,000,000 gallons, while the average for the five years 1908–12 was 43,500,000 gallons of wine and 2,200,000 gallons of brandy. Before the war nearly 800,000 acres of vineyards existed in the Crimea, the Caucasus and Bessarabia, which produced an average of over 77,000,000 gallons of wine per year. The statistics for the production of wines in 1914 were thus stated by the French trade journal, *Moniteur Vinicole* (gallons):

France	1,584,532,000	Brazil	11,887,000
Italy	1,137,136,200	Serbia	9,246,000
Spain	427,108,500	Australia	7,925,100
Algeria	272,563,200	Tunis	7,925,000
Argentine	145,293,500	Uruguay	5,283,400
Russia	126,801,600	Cape of Good Hope	4,623,000
Austria-Hungary	118,876,500	Peru	4,226,700
Portugal	105,668,000	Bolivia	1,226,700
Chile	105,668,000	Bulgaria	1,056,700
Greece and islands	72,646,750	Madeira, Azores and Canaries	792,500
United States	45,965,600	Canada	449,100
Germany	26,417,000	Mexico	224,500
Turkey	21,133,000	Persia	66,400
Rumania	17,461,000	Egypt	39,600
Switzerland	13,393,400	Luxemburg	26,500

In the third year of the European War the French government requisitioned for military consumption 200,000,000 gallons of wine of the 1917 vintage, representing one-fifth of the total production, and also 40,000,000 gallons from her Algerian colony. Storage arrangements were made to receive this enormous quantity of wine, which represented a value of $100,000,000. So essential was the regular supply of pure wine considered for the well-being of the troops that similar exceptional precautions were taken to safeguard the wine crop in Italy, not only for soldiers serving at the front, but also for the sick and wounded in hospitals.

In the United States, the annual product of wine was valued at $13,120,846, but deducting the cost of the grapes and materials used in the process of manufacture, the value was only $6,495,313.

Brandy is the spirit obtained by the distillation of wine. It was known in Europe in the 11th century, though its use did not become general till the 16th century. All brandies should be grape spirits; there are many different types and qualities, though none of greater excellence than those of Cognac, the name of a small town on the river Charente in France. The only brandy entitled to the name of Cognac is that distilled from the wines grown within a limited district known as the Région Délimitée. A good type of brandy, known as Armagnac, is made in the département of Gers; and large quantities are distilled in the south of France, in Spain and every part where the wine industry flourishes.

Rum, in the olden days, used to be distilled from the juice of the sugar-cane, and "tafia" was the name given in the sugar-cane growing districts to the spirit distilled from molasses. The quantity of real rum which is now distilled as of old is almost negligible, and the spirit sold as rum is in practically all cases what is known in the West Indies as tafia.

Gin is a spirit distilled from grain and rectified or redistilled with juniper berries, and is one of the purest spirits made. Holland produces and consumes more gin than any other country; England ranks second.

Absinthe, or wormwood, has long been known as a medicinal plant of value in cases of fever, but it was only at the end of the 18th century that it was first used at Couvet, in Switzerland, for the preparation of a spirituous liqueur. As usually sold it is a spirit containing as much as 72 per cent of alcohol, though some varieties contain only 57 per cent. On account of the deadly ravages it caused among those addicted to it, absinthe is prohibited in Switzerland and France.

Medicated wines are mixtures, consisting usually of port or Tarragona, to which various extracts of meat or malt and many other substances, such as iron, pepsin, cocaine, etc., have been added. Their indiscriminate use is to be deprecated, as they correspond to no formula, and the patient who takes them may be exposed to the peril of becoming the unconscious victim of alcoholism, and, in the case of coca wines, of the cocaine habit as well.

Whisky, variously described as a "universal beverage" and a "universal curse," was practically unknown outside the Celtic races until quite recent times. How and by whom it was invented or discovered is unknown, though it is more than probable that the art of distillation was discovered and rediscovered again and again in different parts of the world. A description of its manufacturing process is given under WHISKY (q.v.); see also ALE AND BEER.

Distilled and Malt Liquors.— The distilled liquor industry of the United States is larger than that of any other country, though it was exceeded by Russia before the ukase of 1915 doing away with vodka. The malt liquor industry of the United States is greater than that of either Germany or the United Kingdom. Taking both liquors together as one industry in the United States it ranks as the eighth in value of manufactured products. This method of measuring the liquor industry is misleading, however, owing to high taxes paid on liquor, which swell the apparent volume of business, when counted in dollars. Measured by the number of employees and of wages paid, the combined liquor industries of the country would rank below the 13th industry. The malt liquor or brewing industry, which is capitalized at over $671,000,000, and has annual expenses of $300,000,000 a year (of which $62,000,000 is taxes), only pays wages of $41,000,000 a year; while the distilled liquor branch of the industry, with over $72,000,000 capital and annual expenses of $200,000,000, pays over $150,000,000 tax, and only $3,000,000 in wages. The manufacture of beer became an active industry in the United States about 1840, being largely due to the energy of the German population.

Capital Invested in Liquor Manufacture.

YEAR	Distilled liquors	Malt liquors	Wines	Total
1850	$5,409,000	$4,072,000	....	$9,481,000
1860	12,445,000	15,782,000	$306,000	28,534,000
1870	15,545,000	48,774,000	2,334,000	66,638,000
1880	24,247,000	91,208,000	2,582,000	118,037,000
1890	31,006,000	232,471,000	5,792,000	269,270,000
1900	32,551,000	415,284,000	9,838,000	457,674,000
1910	72,450,000	671,158,000	27,908,000	771,516,000

Nearly all the liquor consumed in the United States is made in the country. For several years prior to the European War the United States did import about $10,000,000 a year worth of foreign wines, $7,000,000 worth of distilled liquors and $3,000,000 worth of malt liquors, but this trade has been materially reduced. In 1914 the American manufacture was 88,698,797 gallons of whisky, 3,526,085 rum, 4,012,542 gin, 31,715,199 alcohol for beverage, besides 47,132,535 of commercial or denatured alcohol. Besides this there was made nearly 2,000,000,000 gallons of fermented liquor, mostly beer.

Consumption of Liquor.— Both the production and use of alcoholic liquors continue to increase in the United States faster than the growth of population. The per capita consumption, which in 1902 was 19.48 gallons, rose to 22.52 gallons in 1914. The total consumption in 1914 was 2,252,272,765 gallons, of which 2,053,457,000 was malt liquor or beer, 58,381,000 wines and 143,397,000 distilled spirits. The figures for distilled spirits are based on the standard 50 per cent United States proof gallons. This was considerably in excess of any other country, except that France and Italy drink more wine and Germany and Great Britain more beer per capita than the United States. Estimating that one in three of the population use alcoholic beverages, the average consumption of liquor per individual using it is about 68 gallons a year, of which 62 gallons is beer or other malt liquor. The following table shows the consumption of liquors in the United States for 11 years.

YEAR	Distilled spirits consumed			Wines consumed		Malt liquors consumed		Total consumption
	Domestic spirits		Imported spirits	Domestic wines	Imported wines	Domestic malt liquors	Imported malt liquors	
	From fruit	All other						
1905	1,595,021	116,544,802	2,729,826	29,369,408	5,690,309	1,533,325,442	5,201,168	1,694,455,976
1906	1,781,643	122,961,612	3,108,328	39,847,044	6,638,179	1,694,458,014	5,963,207	1,874,758,027
1907	1,993,688	134,308,693	3,782,055	50,079,283	7,659,565	1,815,141,683	7,171,842	2,020,136,809
1908	1,670,031	119,951,185	3,758,098	44,421,269	7,700,377	1,821,418,322	7,314,126	2,006,233,408
1909	1,850,700	114,913,702	4,365,634	53,609,995	8,169,554	1,745,523,769	7,110,657	1,935,544,011
1910	2,204,184	126,593,951	4,340,549	50,684,343	9,863,735	1,844,065,029	7,301,629	2,045,353,420
1911	2,434,045	132,315,123	3,836,821	56,655,006	7,204,226	1,959,671,296	7,240,458	2,169,356,975
1912	2,449,331	133,502,079	3,544,921	50,619,880	5,804,831	1,925,361,507	7,169,677	2,128,452,226
1913	2,801,767	140,521,880	4,121,981	48,683,849	6,643,612	2,022,678,149	7,669,223	2,233,420,461
1914	2,704,752	136,521,805	4,220,670	44,973,643	7,444,787	2,049,236,412	7,170,696	2,252,272,765
1915	2,516,054	121,690,596	2,952,448	27,255,690	5,656,219	1,852,136,960	3,387,324	2,015,595,291

Consumption of Liquors in Principal Countries, in Gallons.

COUNTRIES	Year	Malt liquors	Wine	Alcohol
United States	1914	2,053,457,000	52,418,000	*146,397,000
United Kingdom	1913	1,508,358,000	13,705,000	43,538,000
Russia	1910	269,533,000	....	229,722,000
Germany	1913	1,817,968,000	55,467,000	98,863,000
France	1912	418,500,000	1,758,900,000	80,096,000
Spain	1912	....	350,343,000	....
Belgium	1912	446,422,000	8,453,000	12,812,000
Italy	1912	19,126,000	1,125,366,000	12,046,000
Austria	1912	563,978,000	†129,126,000	‡54,657,000
Sweden	1912	70,216,000	819,000	10,065,000
Norway	1913	13,500,000	1,030,000	2,338,000
Denmark	1912	61,499,000	1,004,000	6,842,000
Portugal	1909	....	146,271,000	....
Netherlands	1913	46,893,000	2,052,000	8,483,000
Switzerland	1912	†82,051,000	62,344,000	3,857,000
Hungary	1912	88,365,000	53,838,000	§43,667,000
Rumania	1909	4,914,000	33,682,000	6,657,000
Bulgaria	1909	3,196,000	34,870,000	581,000

Note.— Alcohol in United States proof gallons (at 50 per cent). * Distilled spirits. † Year 1911. ‡ Year 1910. § Year 1909. ¶ Later data of some foreign countries not available because of war.

During the fiscal year ending 30 June 1916 the consumption of spirits in the United States rose to 139,973,684 proof gallons; of wine, 47,587,145 gallons; beer, 1,818,275,042 gallons; total consumption, 2,005,835,871 gallons. For 1917 the figures were 167,740,325 gallons spirits; 42,723,376 gallons wine; 1,884,265,377 gallons fermented liquors. During the fiscal year 1917-18 a total of 173,476,473 gallons of spirits was produced; 87,787,823 gallons were withdrawn tax-paid, while 158,959,264 gallons remained in warehouses. In June 1918 there were engaged in the production of distilled spirits 72 grain distilleries, 27 molasses distilleries and 137 fruit distilleries, a total of 236 compared with 507 in 1917, 605 in 1916 and 635 in 1915. The decrease in the number of breweries is shown as follows: In 1915 there were 1,372 breweries; in 1916, 1,332; in 1917, 1,217; in 1918, 1,092; showing that 125 breweries went out of business during 1917-18. In 1900 the United States revenue from the liquor traffic amounted to $177,172,000; in 1910, $226,207,000; in 1915, $237,054,000; in 1916, $262,739,000; in 1917 it rose to $297,399,000, and in 1918 to $443,839,544.

In Great Britain the total expenditure on alcoholic liquors during 1915 was estimated at £181,959,000 ($909,795,000), an increase of £17,496,000 ($87,480,000) over 1913, the last normal year before the war.

LIQUORICE. See LICORICE.

LIRA, lē'rạ, an Italian silver coin valued at about 18 cents in American money. It is the basis of the Italian monetary system; the gold coins are pieces of 100, 50, 20, 10 and 5 lire; the silver coins, of 5 and 2 lire, besides 1 lira and a half lira (50 centesimi); also lower coins in nickel and bronze.

LIRRODENDRON. See TULIP TREE.

LISAINE, lē-zăn, **Battle of,** an engagement of the Franco-German War, 15-17 Jan. 1871, on the banks of the Lisaine River near Belfort (q.v). See BOURBAKI CHARLES DENIS SAUTER.

LISBON, lĭz'bŏn, Ohio, village, county-seat of Columbiana County, on the Beaver River and on the Erie Railroad, about 130 miles northeast of Columbus. It is situated in an agricultural region with extensive coal fields in the vicinity. Sheep and cattle raising, the cultivation of grain and vegetables and mining are the prominent occupations in this section. Lisbon is the trade centre for a large portion of the county. It contains also copper mills and manufactories of pottery, sewer pipe, etc. The village owns and operates the waterworks. The public library has about 4,000 volumes. The city was the birthplace of Mark A. Hanna. Pop. 3,084.

LISBON, Portugal, the capital and principal seaport, beautifully situated on the right bank of the Tagus, where the river expands itself out into a lake, about nine miles above its mouth. It is built on a succession of hills, rising from the quays in the form of an amphitheatre. The streets of the older parts, more especially in the east, are steep, narrow, crooked, badly paved and dirty; the houses, with a few exceptions, are old-fashioned and mean. The modern portion, however, which lies on even ground, in the valley between the Monte do Castello on the east and the hills of San Francisco and Do Carmo on the west, consists of several parallel streets crossed by others at right angles, and is regular, well built, clean, traversed by street railways, electrically lighted and provided with a telephone service. Of these the D'Ouro (Gold), Do Prato (Silver), D'Augusta, Do Chiado (Cloth) streets extend about one-half mile, north to south, having at their southern extremity the Praça do Commercio, a large and handsome square, surrounded on three sides by the naval arsenal, the exchange, custom-house and other public buildings, and having the Tagus on the south. At the northern extremity of these streets are the Praça da Figueira, a picturesque square, used as a public market, and a handsome square called the Rocio or Praça de Dom Pedro IV, with a fine bronze statue of Dom Pedro IV, surmounting a tall marble column. To the northwest extends, for nearly a mile, a broad avenue, the Avenida da Liberdade, lined with handsome houses and planted with shrubs, etc. Besides this the finest open spaces are the Estrella Gardens, the Botanic Garden, the Praça do Principe Real and that of Pedro de Alcantara. The western quarter, called Buenos Aires, is airy and pleasant, and here foreigners chiefly reside. The town of Belem, on the west, beyond the river Alcantara, forms a sort of suburb to Lisbon, and has electric car connections. It has a well-known tower, forming one of the defenses of the harbor.

The principal residence is the Ajuda Palace, built of white marble on the summit of a hill. The castle of Saint George is remarkable for the beauty of its situation. Other noteworthy buildings are the cathedral, once a Moorish mosque, on the slope of the Castle Hill, on the east; the church do Coração de Jesus, surmounted by a splendid dome; the church of the Martyrs, erected on the spot where Alphonso I mounted the walls of the city and rescued it from the Moors; the church of Saint Vincent, a Renaissance building of noble proportions, and the burial place of kings; the handsome church of Santa Engracia; the magnificent church and monastery of Belem, in which Vasco da Gama and the poet Camoes are buried, and the church of San Roque. The numerous convents which crown the hills, and appear like palaces and fortresses, are for the most part massive and imposing structures. But unquestionably the most remarkable specimen of architecture is the aqueduct which conveys water to the city from springs rising near the village of Bellas, about six miles distant. It is partly conducted underground, but on approaching Lisbon it crosses the deep valley of Alcantara, which is spanned for nearly 2,500 feet by a bridge of 30 arches, the loftiest of which is 240 feet high and 110 feet wide. An additional supply is brought in by another series of works from a distance of 18 miles. The scientific and literary institutions comprise the Royal Academy of Sciences, founded in the latter part of the 18th century; the well-equipped Polytechnic School, with a museum, botanic garden and observatory; an academy of medicine and surgery; institute of agriculture and veterinary medicine; Marine Academy; Military College, School of Music, National Library, containing about 400,000 volumes, and that of the Academy of Sciences, numbering about 90,000 volumes; the Schools of Vicente de Fora; School of Drawing and Architecture. The harbor, or rather the roadstead, is one of the finest in the world, and the quays and graving docks, which extend for miles along the bank of the river, are elegant and commodious. The exports consist chiefly of wine, oil, fruit, cork, fish, onions and other vegetables and salt; and the principal imports are grain, silk, linen, cotton and woolen cloths, iron, steel, hardware, dried fish, petroleum, colonial produce and coals. The manufactures include various textile goods, tobacco, paper, chemicals and soap; there are also sugar refineries, iron foundries and potteries.

Lisbon was anciently called Olisipo. Successively in the hands of the Phœnicians, Carthaginians and Romans, it was called Felicitas Julia by the last-named. It was captured by the Moors in 716, and remained in their possession till 1147. Vasco da Gama sailed from Lisbon on his famous expedition of 1497. Under the Spanish occupation from 1580–1640 the city greatly declined. In 1755 it was visited by the historic and terrible earthquake, which threw down a considerable portion of the city and destroyed above 30,000 of its inhabitants. It was taken by the French in 1807, but resisted an attack by Masséna in 1809. Pop. about 435,359.

LISBURN, lĭs'bėrn, Ireland, a market and cathedral town in the counties of Antrim and Down, eight miles southwest of Belfast, on the river Lagan. It is in general well built and has a clean and thriving appearance with a market-house and courthouse, the episcopal cathedral church of the united dioceses of Downs, Connor and Dromore, containing a monument to Jeremy Taylor, who died here in 1667; a Roman Catholic church and other places of worship; county infirmary; a fine park, donated by Sir R. Wallace in 1888, etc. It is an important centre of the linen industry. Pop. 12,388.

LISSAJOUS (lē-sä-zhooz') **FIGURES,** curves formed by compounding two simple harmonic motions at right angles to one another. They are generated when a ray of light is reflected from the limb of an upright tuning-fork to the limb of a horizontal tuning-fork, and thence to a screen, a point of which it illuminates. When the tuning-forks vibrate, if they are perfectly in unison the spot on the screen describes a straight line, or a circle, or an ellipse, but if not, various complex curves are described. They can also be formed by the bob of a pendulum, the effective length of which differs in two perpendicular planes. Such a pendulum may be formed by suspending a string and bob from the middle of a string the ends of which are fixed. The equation of a Lissajous curve is of the form

$$\begin{cases} x = a_1 \sin (b_1 + c_1 t) \\ y = a_2 \sin (b_2 + c_2 t) \end{cases}$$

Lissajous curves derive their name from Jules Antoine Lissajous, who presented a paper concerning them to the Paris Academy of Sciences in 1857. Some of his work, however, had been anticipated by Nathaniel Bowditch of Salem, Mass., in 1815.

LIST, Friedrich, German economist: b. Reutlingen, Württemberg, 1789; d. 1846. He began life as a clerk in the public service and in 1816 was ministerial under-secretary. The following year he was appointed to the chair of political economy at Tübingen, but resigned in 1819. He became a member of the Württemberg Diet, but was expelled in 1822 and imprisoned for his censures on the government. He effected his escape and lived successively in Baden, Alsace and in Switzerland. He emigrated to America in 1825, engaged in farming in Pennsylvania but soon became editor of a German journal. Coal was discovered on his farm lands about this time and he became wealthy. He was appointed United States consul at Hamburg in 1830 but the Senate refused to confirm him in this office. Three years later he was made consul at Leipzig, but remained in office only a short time. He became interested in railroad development in Germany and advocated a national navy and a national commercial system for the German states. He traveled in Austria and Hungary in 1844 and England two years later, where he tried to promote a commercial treaty with Germany. His failure in this project caused him to become depressed and he shot himself during a fit of insanity. He wrote ‘Outlines of a New System of Political Economy’ (1827); ‘Das nationale System der politischen Oekonomie’ (1841). Consult lives by Goldschmidt (Berlin 1878) and Jentsch (ib. 1901) and ‘Friedrich List, ein Vorläufer und ein Opfer für das Vaterland’ (Stuttgart); Palgrave, ‘Dictionary of Political Economy’ (London 1899).

LISTER, Joseph (Baron Lister), English physician, the founder of aseptic surgery: b. Upton, Essex, 5 April 1827; d. Walmer, 10 Feb. 1912. The son of a member of the Society of Friends who was engaged in business in London as a wine merchant, he was educated for his profession at University College, London, and became house surgeon at Edinburgh Royal Infirmary under Professor Syme, whose daughter he married. He was professor of surgery at Glasgow University, 1860–69; professor of clinical surgery at Edinburgh University, 1869–77; and from 1877–93 held the same chair in King's College, London, and practised as a consulting physician. His claim to be regarded as the founder of modern surgery is indisputable. The discovery of anæsthetics had widened the field for the surgeon, making possible a vast increase in the number of operations; but his footsteps were followed by a great mortality among the patients due to what would now be attributed to blood poisoning. Lister realised the significance in their application to surgery of the results of Pasteur's experiments on fermentation, and in 1865 he announced his new method of disinfecting wounds, bandages and instruments by means of antiseptic dressings, originally cotton wool and carbolic acid and thereby killing the germs. Later he improved on his methods by the introduction of aseptic surgery, which aims at the exclusion of bacteria in wounds by a scrupulous cleanliness in the operating theatre and the sterilization of instruments rather than by poisoning them after they have obtained lodgment. Summing up Lord Lister's work, the *British Medical Journal* declared that «he had saved more lives by the introduction of his system than all the wars of the 19th century together had sacrificed.» Honors world wide rained thick upon him; he was created a baronet in 1893, raised to the peerage in 1897 and was one of the first recipients of the Order of Merit. He left no issue.

LISZT, Franz, fränts list, Hungarian pianist and composer: b. Raiding, near Odenburg, Hungary, 22 Oct. 1811; d. Baireuth, 31 July 1886. He was scarcely nine years of age when he made his first appearance as a pianist and improvisator in Odenburg and Presburg with such success that several noblemen undertook the expenses of his training at Vienna under Czerny the pianist, and Salieri the composer. In 1823 he made a great sensation as executant and improvisator on the piano in Vienna, Munich, Paris and other cities. His father thereupon traveled with him through France, Switzerland and England for further study of his art. While yet a boy he composed the operetta 'Don Sancho' (1824) and the following year launched out into grand opera at Paris. For a time he experienced the conflict between his religious predilections, which beckoned him to the Church, and his father's wishes for his musical success, which resulted finally in the choice of music as his profession. His hearing of Paganini in 1831 affected him greatly and had a most stimulating influence on his cultivation of virtuosity. In 1835 he had completed his studies as composer for the piano, and in company with the Countess d'Agoult who afterward became the mother of his children (one of whom became the wife of Von Bülow and afterward of Richard Wagner) he began his travels, during which he gave a series of concerts in Switzerland, Italy and Hungary, winding up with some remarkable performances in Vienna. From 1839 to 1847 he made a triumphal progress through the whole of Europe. His success was due less to the astounding power of execution with which he rendered the masterpieces of every age, than to the sublimity, the noble feeling, the depth of expression with which he rendered every number of his program. Honors now were showered upon him; he was made Kapellmeister to the Grand Elector of Weimar; Frederick William IV knighted him, and he was decorated by every court in Europe. In 1848 he settled at Weimar with the Princess Karoline Sayn-Wittgenstein, and became the teacher and «inspirer» of a large circle of young musicians. In 1861 he settled at Rome; in 1865 he took minor orders in the Catholic Church, and became known as Abbé Liszt. In 1870 he was made president of the Royal Musical Academy at Budapest and henceforth lived in turn there, at Rome and at Weimar. The villa in the last city which he occupied now contains the Liszt museum.

In the career of Liszt as a composer there are three distinct periods. The compositions of his first period consist partly of 'Transcriptions' for the pianoforte (a department in piano music inaugurated by him); partly of piano pieces, songs and choruses for male voices. In the second period, during his residence at Weimar, he applied himself to purely instrumental music, in accordance with the principles which he had learned of Berlioz. He sought on the piano to express by a symphony familiar poetic objects and by means of this to adumbrate ideas of a lyric or dramatic order. To this class of compositions belong his twelve 'Symphonic Poems,' namely, (1) 'Ce qu'on entend sur la Montagne' known also as 'The Mountain Symphony'; (2) Tasso's 'Lamento e Trionfo'; (3) Preludes, after Lamartine's 'Notre Vie est-elle autre Chose qu'une Serie de Preludes'; (4) 'Orpheus'; (5) 'Prometheus,' etc. Later in this period appeared 'Missa Solemnis' and 'The Hungarian Coronation Mass.' In his third period, from his residence in Rome to his death, he is chiefly remarkable as a composer of sacred music. He produced the oratorios 'Christus'; and 'The Legend of Saint Elizabeth'; a 'Requiem,' for male voices and the organ; besides 'Cantatas,' 'Psalms,' 'Paternosters,' and short pieces for the church choir. In all these works he followed the method inaugurated by Berlioz and Wagner, and his works indicate the high water mark of the North German school. What perhaps won him most renown were his 'Symphonic Poems' and his sacred compositions, in which latter he strove to blend the liturgical and dramatic elements of music. He was also a musical critic of considerable power. Among his published works may be enumerated 'Frederic Chopin' (1852); 'Lohengrin et Tannhäuser de R. Wagner' (1851); and 'Les Bohemiens et leur musique en Hongrie' (1859). Consult 'Lives' or studies by Coloocoressi (Paris 1905); Göllerich (Berlin 1908); Hervey (London 1911); Kapp, Julius (Berlin 1911); Ramann (Leipzig 1894); Wagner, C. (Munich 1911). His letters were published in eight volumes under the editorship of Maria Lipsius (1893–1905); his correspondence with Wagner appeared in an English translation by Hueffer in 1888.

LIT DE JUSTICE, lē dė zhüs-tēs, a solemn proceeding in France, in which the king, with the princes of the blood royal, the peers, and the officers of the Crown, state and court proceeded to the Parliament, and there, sitting upon the throne or lit, caused those commands and orders which the Parliament did not approve to be registered in his presence. The Parliament had the right of remonstrating in behalf of the nation against the royal commands and edicts. Louis XV held such a lit de justice in 1763, in order to introduce certain imposts, but on account of the firm resistance of the Parliaments he was finally obliged to yield. The last lits de justice were held by Louis XVI in 1787 and 1788.

LITANY (from the Greek *litaneia,* supplication, prayer), a form of prayer or song, first used especially on occasions of public calamity and introduced according to Zonaras and Nicephorus by Proclus, about the year 446, at Constantinople, in the reign of Theodosius; according to Paulus Diaconus, under Justinian, at Antioch, in consequence of the following circumstance: An earthquake, says the legend, having driven the people into the fields, a boy was suddenly taken up into the air in their presence, but was again let down unhurt, on the people crying out «Kyrie eleison!» (O Lord, have mercy). The boy related that he had heard the song of the angels, «Holy God! Holy and Mighty, Holy and Immortal! have mercy upon us!» and this gave rise to the Litany. This kind of common prayer was perhaps not unusual among the Jews, and Psalm cxxxvi seems to have been adapted to this purpose.

The litanies in general use in the Roman Catholic Church are the «Litany of the Most Holy Name of Jesus,» the «Litany of the Saints» and the «Litany of Loreto.» The «Litany of the Most Holy Name of Jesus» is composed of a series of addresses to Jesus Christ, in which the different names by which He is called are used. Like all the litanies it begins with «Kyrie eleison» (Lord have mercy) and ends with an entreaty to the «Lamb of God who taketh away the sins of the world.» This litany is said aloud in the churches by the members of the «Holy Name Societies» on general communion days. The «Litany of the Saints» is composed of supplications to God for favors, the rendition of thanks and a number of petitions to saints asking their intercession. This litany is a part of the special church service for Saint Mark's day, the rogation days, the rubrics for the consecration of churches and cemeteries, for ordinations and for other church services. The «Litany of Loreto» receives its name from being sung on Saturdays and feasts of the Virgin Mary, in the Santa Casa of Loreto. It consists of a number of petitions to the Virgin Mary using her different titles as found in the Scriptures and in sacred writings and asking her intercession.

Litanies are found in the old hymnbooks of the Lutherans, but are no longer used by Protestant Germans. In the Anglican prayer-book the litany is retained, and though it adheres in many respects to the ancient forms, it differs from those of the Roman Catholic Church and contains no invocation of the Virgin or the saints. Since 1661 it is no longer a distinct service, but, when used, forms part of the morning prayer, after the third collect for Grace.

LITCHFIELD, Conn., borough, one of the county-seats of Litchfield County, near Bantam Lake, and on the New York, New Haven and Hartford Railroad, about 15 miles northwest of Waterbury and 28 miles west of Hartford. The first settlement was made in 1719 and the place was called Bantam, but after a few years the name was changed to Litchfield. During the Revolutionary War Litchfield was used for the storage of supplies. The women of Litchfield melted and made into bullets the statue of George III which the people of New York City had torn down from Bowling Green on 9 July. Sarah Pierce opened here, in 1792, a school for the higher education of women. Judge Tapping Reeve, in 1784, also founded here the first law school in the United States. It was patronized by many young men who afterward became prominent in the affairs of the nation. It was the birthplace of Ethan Allen and of Henry Ward Beecher and Harriet Beecher Stowe. Lyman Beecher was a pastor here for 16 years from 1810. Litchfield is situated in a region where grazing and dairying are the prominent industries, but valuable deposits of nickel ore are found in the vicinity. The beautiful scenery, mild climate and places of historic interest make it a favorite pleasure resort. The chief industrial establishments are creameries. Bantam Lake, nearby, is the largest in the State. Pop. 70,260.

LITCHFIELD, Ill., city, in Montgomery County, on the Illinois Central, the Cleveland, Cincinnati, Chicago and Saint Louis, the Wabash, the Chicago, Peoria and Saint Louis, the Chicago and Alton and the Chicago, Burlington and Quincy and Litchfield and Madison railroads, about 50 miles northeast of Saint Louis, Mo., and 45 miles south of Springfield. It is in a good farming section, with oil, coal and natural gas in the vicinity. The chief industries are mining and manufacturing. The principal manufactures are railroad cars, foundry products, glass, briquet ornaments, mine engines, brick, tile, flour, lumber, steel gates and farm accessories, galvanized cans, silos, cement sack bailers, wind-mills and creamery products. The trade is in the manufactures, coal, oil and some farm products. It has good schools, a public library and several prominent buildings. The government is vested in a mayor whose term of office is two years, and in a council, with administrative officials appointed by the mayor and approved by the council. Pop. 5,971.

LITCHFIELD, Minn., village, county-seat of Meeker County, on the Great Northern Railroad, about 63 miles west of Saint Paul. It is situated in an agricultural and stock-raising region. Its chief industries are connected with farm products and the shipping of livestock. It has machine shops, flour and lumber mills, wagon and carriage factory, a foundry and brick yards. Pop. 2,333.

LITCHI, lichʹī, or **LEE-CHEE,** a tree (*Nephelium litchi*) of the soapberry family, native to southern China. It is of moderate size, with brown bark, large leaves and fruit produced in bunches, which are pendant from the extremities of the twigs. Each berry, known in trade simply as «litchi,» is one to two inches in diameter, with a tough, thin, leathery coat and a colorless half-transparent pulp, in the centre of which is a single brown seed. The fresh fruit is pleasantly sweet and reputed to be one of the most delicious known. It is sold extensively in America and Europe in a dried state, and though the pulp is much diminished in size it retains a considerable portion of its original flavor. Attempts have been made to cultivate it in the United States with some success in southern California and Florida, but the tree seems extremely susceptible to cold. Other species of *Nephelium,* as the longan tree (*N. longanum*) of the East Indies, yield similar fruit and seem better adapted to American cultivation. The nuts of the last are smaller and less sugary than those of the litchi, but are regarded by the Chinese, by whom they are also cultivated, as having useful medicinal qualities.

LITERARY FORMS. The term literature is sometimes applied to all printed discourse intended to be preserved for permanent use; but more specifically it is reserved for forms of discourse intended to serve artistic rather than utilitarian purposes and developed chiefly by the processes of the imagination rather than those of the reason and the sense of fact. (De Quincey, in a famous passage, distinguished this class of writings as «Literature of Power,» in contrast to «Literature of Knowledge»). These forms are classified most inclusively under the main divisions of prose literature and poetry, though some, like the drama, exist amphibiously in both divisions.

Prose Literature.

The *Essay* is the simplest form of prose discourse, and the form most closely related to the «literature of knowledge.» In the least developed type it may be looked upon as a collection of gnomic sayings or aphorisms and be called Gnomic or Aphoristic. In the Old Testament 'Book of Proverbs' one may see, in certain chapters, the aphoristic essay growing out of the mere collection of aphorisms. For English literature the chief example of this type is the Essays of Francis Bacon (q.v.). If, instead of expressing general ideas, the writer sets down his individual experiences and feelings, frankly representing his personality rather than abstract truth, the essay becomes personal or familiar; of this type the chief example in English literature is the 'Essays of Elia' (q.v.), by Charles Lamb. A further development takes place when the essay represents critical thinking, elaborated on themes literary, political, historical, etc.; often this type takes its rise in a book review. It may be called the critical or expository; the chief example in English literature is the Essays of Lord Macaulay (q.v.). See further under Essay.

Prose *Fiction,* or imaginative narrative, is closely related to poetry, because so freely creative in character; and at certain periods, notably in the Middle Ages, the distinction between prose and verse romance is almost negligible. In general, fiction is most distinctively classified under the two heads of Romance and Novel. The romance deals characteristically with the unfamiliar or wonderful — with matters distant in time or space, with heroic or supernatural adventure, and with romantically moving backgrounds and emotional situations; the novel deals characteristically with the familiar, with the sense of reality and the representation of the problems of contemporary life. The romance, therefore, tends to be more poetic and to be less concerned with ethics and social organization; the novel tends to be more critical — often satiric, and frequently, though not invariably, concerns itself with sociological and kindred themes. A third type, the tale or (as it is now commonly called) the short story, may partake of the character of either romance or novel; the short stories of Hawthorne and Poe exemplify the former tendency, those of recent American writers like Sarah Orne Jewett and «O. Henry,» the latter. Poe distinguished, in a well-known passage, the true short story (which some prefer to write «Short-Story») as one which can be read at a single sitting, and in which every word contributes to a single preconceived effect. Between this and the novel stands the novelette, in which the method of the novel is followed in abbreviated form. See further under Novel; Romance.

The *Drama* is fiction presented not in the words of the author, but solely through the action and speech of the imagined characters. This type is commonly classified as comedy and tragedy; formerly comedy was distinguished as dealing with unimportant personages and with the complications of common life, tragedy as dealing with great personages and lofty and fateful themes, but in modern times the usual distinction is based on the prevailingly «happy ending» of comedy and the hero's defeat (and, usually, death) characteristic of the end of tragedy. In the period when tragedy normally confined itself to characters of rank or importance, an exceptional type was often distinguished as bourgeois tragedy, or tragedy of common life. Comedy may be conveniently classified as comedy of manners, romantic comedy, and farce. The comedy of manners satirizes familiar types of contemporary life; examples are the chief plays of Ben Jonson, in the Elizabethan Age, and of Bernard Shaw in the present. As this sort of comedy is akin to the novel, romantic comedy is akin to the romance, dealing with the less familiar side of experience, and treating it sympathetically rather than satirically. Shakespeare remains the chief exemplar of romantic comedy; it does not flourish in modern times. Farce is comedy based on amusing action, in which plausibility of plot and emphasis on character are frankly abandoned. (Farce is sometimes distinguished as «low comedy,» comedy based on the delineation of character as «high comedy»). Besides these principal types, various mixed or indeterminate forms must be noted. Tragi-comedy — a term chiefly used in the 17th century — is drama dealing with dignified persons and serious events, but reaching a solution instead of a catastrophe; Shakespeare's 'Cymbeline' and 'A Winter's Tale' are examples (though the former was classified as a tragedy, the latter as a comedy, in the folio edition of his plays). To these late Shakespeare plays of blended character the term «Romance» is also applied. Modern usage tends to call the blended type simply «a play» or a «drama» (French *drame*); this class may also include plays which end with death or disaster (like Rostand's 'Cyrano de Bergerac' and Ibsen's 'Hedda Gabler'), which for one or another reason the dramatist does not wish to call tragedies. The Melodrama (originally meaning music-drama) is a term somewhat loosely applied to what might be called the serious farce,— a drama dependent on incident rather than character, and appealing not to the comic sense but to the sentiments. The Masque (or Mask) is an early form, occasionally revived in the present time, in which music and pageantry are used to embellish the dramatic art, and in which the characters are usually symbolic or allegorical; the chief English example is Milton's 'Comus' (q.v.). See further under Drama.

In addition to the definitely established types of prose literature, there remain certain kinds imperfectly definable, of which one might note the fantasy or prose-poem,— a form of composition seeking the effects of poetry while keeping to the medium of prose. In English literature the chief examples are certain reveries of De Quincey, such as that called 'Levana and Our Ladies of Sorrow.'

Poetry.

For the definition of poetry in general, see under Poetry. Poetic literature is commonly classified as Narrative, Lyrical, or Dramatic, though there are certain other subsidiary kinds.

This distinction is primarily based on the poet's subject matter and his relation to it. In narrative poetry the principal subject is action, objective or external, usually related by the poet as one standing outside it; in lyrical poetry the principal subject is feeling, personal or subjective, expressed by the poet as for himself or for an imagined speaker; in dramatic poetry the subject is both action and feeling, but the action is represented objectively while the feeling is expressed subjectively by the various characters.

Of *narrative poetry* the chief types are those of early periods, this kind having greatly diminished in significance in the modern period characterized by the rise of prose fiction; these chief early types are Epic and Ballad. The epic is a long narrative poem dealing with heroic adventures of a traditional character, usually concerned with national or racial themes and involving supernatural elements. One may distinguish the primitive or communal epic, like the 'Iliad' (q.v.), of uncertain authorship and representing the legendary of a whole race rather than the invention of an original poet, and the individual or art epic, like the 'Æneid' (q.v.), representing the conscious art of a single composer. Modern epics, like Milton's 'Paradise Lost' (q.v.), are usually written in deliberate imitation of the ancient, with an application of the old methods to more reflective or spiritual subject matter than is characteristic of the primitive type. The Ballad is a shorter narrative, intended to be recited (in early days perhaps more commonly sung) at a single sitting, and dealing with a single adventure or episode of popular story. Many of the old ballads centre about certain popular themes and heroes, forming what is called a «cycle»; the best-known example is the cycle dealing with Robin Hood and his outlaws of the Greenwood. Another early type, though belonging to the era of written rather than oral poetry, is the Metrical Romance, distinguished from the epic very slightly at times, but chiefly in being less concerned with national themes, and more with those of chivalric adventure and love. Like the ballads, the romances appear in cycles, the most notable examples being those concerned with the story of King Arthur and the knights of the Round Table. In modern English poetry the metrical romance was revived by Walter Scott and Lord Byron. The Fabliau, still another mediæval type, is a humorous tale analogous to the comic short story in prose. In general, modern narrative verse avoids the following of fixed types. The term Idyl has been loosely and variously used,—most often to describe a narrative poem with a large descriptive element, especially in pastoral setting, but in a special sense by Tennyson, for the separate narratives (spiritualized reworkings of Arthurian romances) which he called 'Idylls of the King' (q.v.). Finally, we may note that occasional experiments have been made in the use of poetry for narratives of familiar life in the manner of the novel; examples are Clough's 'Bothie of Tober-na-Vuolich' and Owen Meredith's (Lord Lytton's) 'Lucille' (q.v.).

Lyrical Poetry is characterized on the one hand by its association with music, and on the other by the personal or subjective feeling which it normally expresses. Its simplest and most typical form is the Song. As the type develops, with the natural course of civilization, a larger and larger element of reflection, or intellectual expressiveness, is added to the originally simple and song-like utterance of feeling, resulting in what may be called the Reflective Lyric. Of the song-lyric the poems of Burns are the most important examples in modern English literature; of the reflective lyric the chief masters are Wordsworth, Shelley and Tennyson (e.g., 'Tintern Abbey,' 'To a Skylark,' 'Tears, Idle Tears'). Special forms of the reflective lyric are the Ode, the Elegy, and the Sonnet. The term Ode is loosely applied to a lyric of a highly dignified or impassioned character, elaborated at some length, especially when addressed to some personified idea (as Coleridge's 'Ode to France' and Wordsworth's 'Ode to Duty') or expressive of public feeling on some important occasion (as Tennyson's 'Ode on the Death of Wellington' and Lowell's 'Commemoration Ode'). The Elegy is (for English usage, having a much more general significance in classical poetry) a lyric expressive of melancholy or grief, in particular when commemorative of a dead friend. The most representative examples are Milton's 'Lycidas' and Shelley's 'Adonais'; of a somewhat different character is Gray's 'Elegy in a Country Churchyard' (q.v.), where the unknown dead of an entire village are celebrated. The Sonnet is a condensed reflective lyric, devoted to the expression of a single idea or moment of feeling, and is always 14 lines in length. Two forms are distinguished: the Italian, in which the poem divides itself into two parts, octave and sestet, usually with some corresponding division of the thought; and the English, in which the natural divisions are three quatrains and a concluding couplet, with a correspondingly more progressive development of the thought. The chief English sonneteers in the Italian form are Sidney, Milton, Wordsworth, and Rossetti; in the English form, Shakespeare and Drayton.

We may also note under the head of lyrical poetry certain forms which in a sense combine the method of lyric with that of narrative. Thus a poem may be at once song and story, or be intended equally to express feeling and narrate action; for this the term Lyrical Ballad has been used, notably by Wordsworth, who said that in his narrative poems called by this name the reader was to understand that the feeling awakened «gives importance to the action and situation, not the action and situation to the feeling.» Or, a poem may represent a song expressive of the feeling of a particular imagined person in a particular situation; for this the term Dramatic Lyric is used, notably by Browning (e.g., his 'Cavalier Tunes'). If it is the speech, rather than the song, of an imagined character, reflectively developed, the poem is called a Dramatic Monologue; this is one of the most characteristic of modern types, being represented especially in the work of Tennyson and Browning (e.g., the former's 'Ulysses,' the latter's 'My Last Duchess'). In the poem 'Maud' Tennyson told the story through a series of dramatic lyrics and monologues, and called the whole a Monodrama.

Dramatic Poetry is not, in general, distinguished in its kinds from those of prose drama; see, therefore, the account given above under prose forms. For the most part, the use of poetry in drama is confined to tragedy and romantic comedy, and even there, in modern English drama, it has been largely displaced by prose.

A separate class is sometimes made for *Descriptive Poetry*, as represented by examples like Thomson's 'Seasons'; but description in poetry, as in prose literature, is usually subordinated to some more characteristic end. Still another class is made up of *Didactic* or *Expository Poetry*, in which the functions of prose are most closely approximated, for the exposition of ethical or social theory; important examples in English literature are Dryden's 'Religio Laici' and Pope's 'Essay on Man.' Wordsworth's 'Excursion' combines the methods of narrative and didactic poetry. Finally, we may note a type sometimes called Familiar Verse, more frequently *Vers de Société*, which may be either narrative or lyrical in form, but is distinguished by its own mood and style; it is witty or humorous in tone, in style suggestive of polite conversation, and deals generally with the manners of artificial society rather than with those fundamental themes (like nature, love, and death), which form the chief subject matter of serious poetry. Important examples, for English literature, are Pope's 'Rape of the Lock' (in form a mock-epic), and various short poems by W. M. Praed, C. S. Calverley and Austin Dobson. For *vers de société* modern writers often employ certain fixed forms of verse derived from mediæval French usage, such as the Ballade, the Rondeau or Rondel, and the Triolet; these follow exact and difficult arrangements of rime, and are marked by the repetition of a pointed refrain.

In Latin literature, and in English literature of the Renaissance and the 18th century, *Satire* is a distinct form of poetry,— the imaginative indictment of contemporary follies and vices. In modern literature no such distinct type is commonly recognized, but the mood and purpose of satire may be discovered in prose or verse, and in narrative, lyrical or dramatic form. Somewhat similarly, the *Pastoral* or *Eclogue* was a recognized form of poetry, under classical influence, in the Renaissance and later; Spenser's 'Shepherd's Calendar' forms an important collection. But the term Pastoral was loosely used, and is now applied as an adjective in connection with romance, drama or lyric, when the theme concerns the traditional beauty and happiness of rural — particularly shepherd — life.

Bibliography.— For works dealing with the separate literary forms, see under ESSAY, DRAMA, NOVEL, and POETRY. For the types in general, consult Gayley and Scott, 'Introduction to the Methods and Materials of Literary Criticism' (Boston 1899); Painter, F. V. N., 'Elementary Guide to Literary Criticism' (Boston 1903); Hunt, T. W., 'Literature, its Principles and Problems' (New York 1906); Hudson, W. H., 'Introduction to the Study of Literature' (Boston 1910); Moulton, R. G., 'The Modern Study of Literature' (Chicago 1915).

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LITERARY LABOR SAVERS. See OFFICE LABOR SAVERS.

LITERARY PROPERTY. See COPYRIGHT.

LITERATURE (in Latin, *litteratura, literatura*, writing, from *littera*, letter), in the widest sense is the expression, representation or manifestation of thought by means of alphabetic symbols called letters — the products being considered as a collective body, without special regard to the excellence and beauty of the form of expression. But in a restricted and usually preferred sense only the more polished or artistic class of such products, together with the critical knowledge and appreciation of them, may be called literature; for the term is, according to this latter usage, applied exclusively to writing which has claim to consideration on the ground of beauty of form or emotional effect. Thus, a declaration conforming to the latter usage is John Morley's often cited sentence: "Literature consists of all the books . . . where moral truth and human passion are touched with a certain largeness, sanity, and attractive form"; and the best recent expression of the same high view is to be credited to Lieut. Coningsby Dawson, who writes in October 1917: "In the light of my experience at the front, the petty personal problems which we cloak in words and call literature seem so ignoble a presentation of men and women who are planned for immortality and live in an infinite world." The passport to this higher class (literature in the usually preferred sense and *belles-lettres*) is the possession of what is known as literary quality; and the foregoing statements enable us to conclude that any work in this field should, if its possession of this passport quality is to be fully conceded, rise above pettiness or triviality of thought and expression, and should attain or approximate not only attractiveness of form but also soundness and adequacy of treatment.

There is certainly room for doubt as to the correct classification of the main divisions of this subject, especially in regard to the admission or exclusion of distinctive groups. For instance, the literary quality of a work in the field of science or in the field of oratory (after the oration has been printed) may be so marked and striking that we easily think of the former as literature in the restricted, and not merely in the widest, sense; and we may also, and almost as easily, overlook the fact that oratory must be held to be expression by vocal sounds and not primarily representation by alphabetic symbols. On the other hand, some of the dramatic works that are now by common consent classed as secular literature's best offering were originally designed simply to be acted, to be played, and without one thought of the effect they would produce when printed and read. In general usage, however, six or seven main groups are recognized, and all of these, except the first and the last, were developed in Greece or Greek colonies before (some of them long before) the middle of the 4th century B.C. We have thus the literature of religion, of philosophy, of poetry (epic, dramatic and lyrical), of history, of oratory (unless this be excluded for the reason already mentioned), of criticism and of fiction. In this work the literature of the several peoples of the world, both ancient and modern, are treated fully under their special or national titles, as American Literature, Celtic Literature, English Literature, Greek Literature, Latin Literature, Latin-American Literature, Jewish Literature, Lithuanian Literature, Persian Literature, Polish Literature, Russian Literature, etc., etc. Reference to the Classified Index will give a complete list of articles dealing with special periods or phases of literature and literary history, as Comparative Literature, Classical Literature, Literature of the Middle Ages, Elizabethan and Victorian literatures, etc. In addition, the great masterpieces of world literature have received special treatment under their own titles, giving an outline of the plot, characters, literary excellence and literary history of the work in question, e.g. Hedda Gabler, Autobiography of Franklin, Man without a Country, Jane Eyre, Peter Ibbotson, Hernani, Gil Blas, La Vita Nuova, Amiel's Journal, Anna Karenina, Kalevala, Madame Bovary, etc.

LITERATURE, ART AND MUSIC, Influence of the World War On. All wars have a profound influence on the life and thought of the nations — they either sterilize when disasters are overwhelming or awaken to new energy when conditions are more favorable. The inspiration of any momentous and long-continued struggle is contagious — it spreads from camp to city and enters every sphere of activity, molding a nation's literature, art and music, spheres that are so readily affected. Naturally the full force of that influence may not be felt immediately, but it cannot long be deferred nor its importance underestimated. For war in intensifying the sense of nationality arouses attention to those lines of activity in which nations take special pride — arts and letters.

The war of 1914 had at first an unfavorable effect on literature, with the whole bent of the nations turning in other directions. The old Latin proverb that amid arms the laws are silent has a much wider application. A shrinkage followed in the output of books; and literary plans, including notable translations, had to be changed or deferred in the severance of relations with the Central Powers and the added difficulty of research work in certain lines. It did not take long, however, before compensation followed in the rapid output of war literature. It was found necessary after October 1918, owing to the shortage of paper, for American publishers in the interest of economy to cut down the number and titles of books for general readers as well as in some lines of textbooks. The total number of books, inclusive of pamphlets, issued in the United States in 1914 was 8,563; in 1915, 6.932; in 1916, 8,430; in 1917, 8,107; in 1918, 7,686. The decrease in fiction and in general literature for 1918 was more than counterbalanced by war books in different lines.

The various departments of war literature included diplomacy of war, diaries of diplomatists, international relations between United States and Germany, documentary histories of diplomatists. Then comes newspaper correspondence, usually reprinted in book form, the causes of war, military history, war poetry, soldiers' letters, fiction in the style of Wells, Sinclair and Barbusse, personal sketches, novels, camp journalism, — wide in range and variety of subject. Happily the tension of war has not been allowed to interfere with the average reader's enjoyment of books. The work of the American Library Association in providing a million and more books for various camps, the result of a public appeal, was of marked value.

It is difficult to be specific in examples of war literature that have merit enough to be given mention here. Many books of the day are written only for the day, and quickly pass into forgetfulness. In the haste of composition and lack of literary qualities, the majority of war books belong to that category. Some will be treasured as keepsakes or considered as curiosities of a notable epoch, and be consigned to the vault with curios, antiques, etc. A few works, however, have done their share in forming public opinion. Schreiner's 'From Berlin to Bagdad'; Wood's 'The Cradle of the War'; Jastrow's 'The War and the Bagdad Railway,' have undoubted excellence and historic value. Dr. Mühler's 'The Vandal of Europe,' his diary in the early days of the war, has its place next to Prince Lichnowsky's famous 'Memorandum,' as the most-talked-of books of the era. In fiction 'The Four Horsemen of the Apocalypse' by the Spanish novelist Ibanez is a war story vibrant with Spanish feeling, while Malherbe's 'The Flame that Won' gives the emotional French point of view. In poetry, which is never ceasing, as Leigh Hunt puts it in an oft-quoted sonnet, Frank Foxcroft's 'War Verse' will be found fairly representative. Those who like to read soldiers' letters, many of which are written with much simplicity of diction and beauty of thought, may turn to the 'The Good Soldier,' by N. P. Dawson. Villiers' 'Britain after the Peace' opens up the question of revolution or reconstruction for Great Britain after the war.

It will take some years before the authoritative history of the war, with broad vision and free from prejudice, will be written. Diplomatists' diaries, written originally for the magazines and utilized by the movies, while vivid and suggestive, lack the even poise and dignity of histories. The far-sighted, well-balanced historian demands a few years of preparation and another perspective than that of the journalist or the occasional letter-writer. A practical help for the future historian has been begun in the Universal Library of Bologna, Italy, with its collection of books, pamphlets, publications, photographs, documents, etc., pertaining to the war of 1914–18. The works are catalogued under 800 different classifications and numbered at the close of 1918 nearly 10,000 volumes and pamphlets, exclusive of rare documents and special reviews. The collection is not restricted to Italy but includes every country and phase of the war.

It is generally admitted that the war interrupted a general renaissance of industrial art in Europe. In England, it is true, thanks to William Morris and his immediate predecessors, the awakening had already come. In fact in the summer of 1914 an exhibition of the decorative arts of Great Britain was held to show the French people how far England had advanced in the task of making artisans of her artists and artists of her artisans. In the same year in the report to the London county council of the Central School of Arts and Crafts, it was stated that «workmen, employers, and educationists are awaking to the need of an organized scheme of education in art which shall be both ideal and practical.» Further and more detailed testimony to the progress of art education in England are furnished by the special autumn number of 1916 of the *International Studio*, which gave a careful review of the work done by students in a limited number of the leading art schools of Great Britain and Ireland. The problem of meeting foreign competition is being resolutely met.

In the United States the war has not been allowed to check efforts in industrial art, but the modest beginning made will be developed in due course when suitable methods adapted to our people will be acquired. France has shown its vigilance by organizing in war time its art teaching and establishing committees to ascertain conditions and requirements in its various manufacturing centres. Paris had an exquisite display in the exhibition of Pagnot typography in 1918. The four brothers of that name, who were leaders in the book art, had fallen in battle. In other lines the master craftsmen have had their gatherings and demonstrations — the metal workers' craft showing a particularly remarkable development.

As the direct outcome of the world conflict has sprung into prominence what might be termed the technique of war, in which the influence of impressionists and cubists might be traced as well as that of legitimate art, under the popular name of camouflage. Among English painters C. R. W. Nevinson with his 'Searchlight' merits the highest praise for the genius displayed; among the French, Faivre and Farré may be mentioned. The entrance of artists and craftsmen in this field of art was everywhere successful and their work in the military and naval service was very helpful. If America owes the initiative to the camouflage corps of the French army, it has shown an ability and a versatility of its own, especially in the problem of marine camouflage. Patrol boats and merchantmen have been painted so as to create low visibility at sea. In New York the work has been chiefly concerned in designing and carrying out street decorations for the many receptions given to commissions from the Allies, which culminated in the Avenue of the Allies for the Fourth Liberty Loan drive, of whose fine features perhaps the most remarkable was the series of paintings done by American artists, one each day, to commemorate the spirit of the 22 nations engaged on our side of the world struggle.

Further work of the artists was to make signs and posters for the army and navy to encourage enlistment — which were scattered all over the country. As a consequence, a camouflage corps was formed for service in France, and it included painters, sculptors, architects, craftsmen such as scene painters, stage carpenters, plaster cast molders and masons. Thus France received a little repayment for her copyright in camouflage. Some further commendable work in this direction was done by artists beyond the draft age in sending original paintings and decorative pieces to the various rest homes and Y. M. C. A. huts. Thus art was brought into the lives of our soldiers in the many centres of army life in America and France, to wield a more than transient influence on character and efficiency both during war time and the peace that was to follow.

As to the effect of the war on art prices, any inquiry is legitimate. We shall probably witness a change in the class of art purchasers and the appearance of a new coterie of wealthy buyers, with whom an intelligent appreciation of the best work is only a matter of time, and who at first will pay higher prices.

American music has to be grateful to the war for a larger share of attention and appreciation. The tendency to lay emphasis on the foreign element both in programs as well as in education has been followed by a proportionate higher regard for the American teacher and methods as well as for the typical American features in composition. If Wagner went to mediæval Teutonic legends for his themes, why cannot the American utilize the Indian chant and folklore with as superb results? It all depends upon the genius and equipment of the composer. There is possibly a larger field for the American music-drama in the very complexity of the American nation and the rôle it has assumed in diffusing democracy in all lands — a field which offers a richer opportunity both for theme and elaboration.

The first effect of the war was hardly inspiring in the flood of patriotic and war songs, only a few of which possessed fair merit. Next followed a change in the concert program, with the Teutonic music less and less represented, and greater prominence given to French, English, Italian, Russian and even Japanese composers. Bands of music and special artists from the Allied nations toured the country and did much to increase popular knowledge and appreciation. A number of prominent symphony societies in our large cities were obliged to dispense with their German conductors.

It was a timely protest against tendencies that seemed likely to injure American standards of music when the Musical Alliance of the United States was founded by John C. Freund, whose aim was to add a Secretary of Fine Arts to the Cabinet. A further step was the effort to organize a National Conservatory of Music and Art, which was introduced in the House of Representatives on 17 June 1918. Its purpose was the national control of music and revised standards of music. It was shown that there was no need to pay many millions yearly and educate in music boys and girls abroad, when our own country afforded opportunity for good training, if it could only encourage its students as a number of European nations do. It was pointed out forcefully that music was more than an accomplishment and a luxury for the rich — it was a great ethical force and «a factor in refining and elevating character.»

In marked contrast to the attitude of Germany and England where the music of enemy countries was played and sung, the United States witnessed a boycotting of German music at recitals and concerts — a war measure that had both its critics and supporters. Mr. H. T. Finck mentioned the case of the French government which arranged concerts for the wounded, and allowed the preference for Bach, Beethoven, Mozart and Schumann to be granted.

The war stimulated recitals and musical entertainments for war charities, giving a more cosmopolitan character to programs. It had its effect, also, on community and pageant music in our larger and smaller cities and the development of mass singing in the army camps. Abroad the war possibly encouraged the managers to produce many novelties at the various capitals — London, Paris, Rome, Berlin, Vienna. At least it had no adverse influence. One interesting fact might be mentioned — a Welsh composer of much power gave to the public a number of excellent songs, some of which were written in the German prison camp at Ruhleben. If a Bunyan could write in prison, why cannot a singer compose in captivity?

One may confidently anticipate a marked revival in popular interest in music after the war — the efforts made at camp and cantonment, abroad and at home, to reach the soldiers cannot fail to have more than a transient influence. The public school is likely to develop as a music centre and music will prove more and more a factor in public enlightenment.

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LITERATURE, Comparative. 1. History and Development of Study.— Comparative literature is a term that only within the last 30 years has come into prominence, but is applied to so many different fields and lines of research that it would be difficult to find two scholars who would agree absolutely on the particular scope and purpose of this discipline. The English term,— obviously a misnomer,— seems of quite recent coinage, whereas the corresponding French, German and Italian terms have been in use for nearly a century (Littérature comparée; Vergleichende Literaturgeschichte). The first scholar who projected a study of human civilization on a philosophical and comparative basis was Francis Bacon: some remarkable adumbrations of modern theories of evolution may be found scattered through his 'Instauratio magna.' Other pathfinders in this field are the Italian Giovanni Vico, 'Scienza nuova' (1725); Dryden, John Dennis, Thomas Warton in England; Perrault, Saint Evremond, Montesquieu, Batteux in France; Baumgarten and Winckelmann in Germany. The greatest synthetic mind of his age was Herder whose ambition it was to understand all literary phenomena as manifestations of deeper cultural impulses and who first insisted upon a relative valuation of literary productions according to the specific character and genius of each individual nation. Goethe's broad humanitarian views and genuinely cosmopolitan tastes remain an inspiring example for all times. It is one of history's little ironies that many of these critics, like Perrault, the Warton brothers and Herder, were primarily moved by the desire to defend their aspirations toward a national literature against the tyranny of absolute standards or traditions and that, in speaking *pro domo,* they were indirectly obliged to speak *pro universo.* The Romantic movement gave a new impetus to the expansion of literary interests all over Europe. The rediscovery of the forgotten treasures of mediæval poetry, or older ballad and saga literature, the opening up of the Oriental world and the study of Southern literatures,— all these activities tended to enlarge the horizon, although they contributed very little to comparative analysis. It is sufficient to mention the names of Coleridge and Scott, of the Schlegel and Grimm brothers, of Mme. de Staël and Ampère, and to remind of the fact that three leading French periodicals: *Le Globe, la Revue des deux Mondes,* and especially *la Revue Européenne,* were international in character and had correspondents in all European countries. From 1850 on, with the strengthening of the philological disciplines on one side and the rapid growth of biology and sociology on the other, new tendencies and methods were introduced in the treatment of literary problems. Philological analysis resulted in a large number of investigations in which literary currents, themes and forms were traced through different literatures or periods and studied in their reaction upon each other. Benfey's 'Pantschatantra' (1859), in which literary relations between Orient and Occident are investigated, was one of the first attempts in comparative criticism, although Dunlap's 'History of Prose Fiction' and Graesse's 'Sagenkreise des Mittelalters' (1837) should not be omitted as earlier forerunners. The philosophical and synthetic tendency, on the other hand, drew inspiration from biology, ethnography and sociology, in particular from the new gospel of evolution and its prophets from Darwin to Weismann and De Vries. The influence of environment, climate, race, social institutions upon literary life was studied and laws were formulated to explain the growth and decline of literary types and forms. The theories of Taine, Letourneau, Posnett, Brunetière, Manly and others are the result of these investigations. At the present time literary research shows rather a preponderance of technical and analytic studies, but a certain speculative element is noticeable in many of them and some biological analogies seem to have become established.

2. Field of Study and Topics for Investigation.— There is no reason why any literary problem within any field should not be treated in a comparative spirit, but it seems reasonable to limit the term "Comparative Literature" to investigations which do not merely introduce parallels and analogies occasionally, but make them their chief end and object. It will not be difficult, within these boundaries, to set aside certain topics and problems as belonging primarily to the domain of Comparative Literature. The following list may serve this purpose. From the inexhaustible supply of books and articles only a few are quoted in each case to furnish illustrations. (a) ***Authors*** (comparisons for the purpose of analogy or contrast; for studies in literary influence see under d): Stendhal, 'Racine et Shakespeare' (Paris 1823); Stapfer, P., 'Molière et Shakespeare' (Paris 1890); Bekk, A., 'Shakespeare und Homer' (Leipzig 1885); Wiehr, J., 'Hebbel und Ibsen' (Stuttgart 1908); Raveggi, P., 'I poeti della visione celeste: Dante, Milton, Klopstock' (Firenze 1903); Betz, L., 'Heine und Musset' (Zürich 1897). (b) *Literary Productions* (comparisons, not including studies of influence): Bauer, 'Das Buch Hiob und Dante's Göttliche Komödie' (Gotha 1904); Meinck, 'Hebbels und Wagner's Nibelungen Trilogie'

(Leipzig 1905); Moguel, A., ‘Calderon's Magicien prodigieux et Goethe's Faust’ (Paris 1883). (c) *Literary Themes, Legends, Types, Motifs:* Paris, G., ‘Histoire poétique de Charlemagne’ (Paris 1865); Castle, E., ‘Die Isolierten Varietäten eines literarischen Typus’ (Berlin 1899); Mallinger, L., ‘Médée. Etude de littérature comparée’ (Paris 1897); Simone-Brouwer, ‘Don Giovanni nella poesia e nell' arte musicale’ (Napoli 1894); Berg, L., ‘Der Uebermensch in der neueren Literatur’ (Leipzig 1897). (d) *International Relations, Imitations, Sources and Influences:* Comparetti, D., ‘Virgilio nel Medio Evo’ (1896); Reinhardstöttner, C. von, ‘Plautus in der Weltliteratur’ (Leipzig 1896); Rossel, V., ‘Histoire des relations littéraires entre la France et l'Allemagne’ (Paris 1897); Schmidt, E., ‘Richardson, Rousseau und Goethe’ (Jena 1875); Oelsner, H., ‘Influence of Dante on modern thought’ (London 1895); Baldensperger, ‘Goethe en France’ (Paris 1904). (e) *Literary Currents and Tendencies:* Egger, E., ‘L'Hellénisme en France’ (Paris 1869); Texte, J., ‘Rousseau et les origines du cosmopolitisme littéraire’ (Paris 1895); Brandes, G., ‘Main Currents in Nineteenth Century Literature’ (New York 1905); Hamann, R., ‘Impressionismus in Leben und Kunst’ (Cologne 1907). (f) *Literary Forms, History of Genre:* Bédier, ‘Les Fabliaux’ (Paris 1893); Rajna, ‘Le origini dell'epopea francese’ (Firenze 1884); Greg, W., ‘Pastoral Poetry and Pastoral Drama’ (London 1906); Fürst, R., ‘Vorläufer der modernen Novelle’ (Halle 1897); Bovet, E., ‘Lyrisme, épopée, drame’ (Paris 1911). (g) *Æsthetic Emotions:* De Laprade, ‘Histoire du Sentiment de la Nature’ (Paris 1883); Biese, ‘Entwicklung des Naturgefühls’ (Leipzig 1888); Kawczynski, M., ‘Essai comparatif sur l'origine et l'histoire des Rythmes’ (Paris 1889); Volkelt, ‘Æsthe tik des Tragischen’ (München 1897). (h) *Literature as Determined by Intellectual or Emotional Currents, Social or Political Institutions, Physiographic Conditions, Racial Factors; Correlation of Literature and Art, etc.:* Posnett, H. M., ‘Comparative Literature’ (London 1886); Carrière, ‘Die Poesie, ihr Wesen und ihre Formen’ (Leipzig 1884); Letourneau, C., ‘L'évolution littéraire dans les diverses races humaines’ (Paris 1894); Mackenzie, A. S., ‘The Evolution of Literature’ (New York 1911); Maigron, ‘Le Romantisme et les Moeurs’ (Paris 1910); Stephens, ‘English Literature and Society’ (London 1903); Grosse, E., ‘The Beginnings of Art’ (New York 1897); Hoskins, F. P., ‘Biological Analogy in Literary Criticism,’ *Modern Philology* (April 1909).

There is no reason why the comparative and international point of view should not be applied to narrower fields within national or even provincial boundaries. Scherer for instance in his ‘History of German Literature’ is very fond of comparing or contrasting writers for purposes of “reciprocal illumination,” to use his favorite term. Schiller's famous essay on “Naive and Sentimental Poetry” may be cited as one of the few cases in which two widely remote epochs of human thought are contrasted.

3. Principles of Comparative Criticism.— These may be reduced to three: evolution, valuation and causation. The principle of evolution covers problems stated under (h), (f) and (c): literary history, forms and themes. In how far biological laws may be safely applied to literary problems is a question that might arouse scepticism. Works of art, the organization of the human mind and the whole process of intellectual transmission are such complex phenomena that biological facts or theories could furnish only very crude analogies. Sociological theories have been applied by Posnett in his book on ‘Comparative Literature’ in which literary evolution is traced through the four stages of clan life, city, commonwealth, national life and cosmopolitan humanity. The ethnographical point of view dominates in Grosse's ‘Anfänge der Kunst’ and Mackenzie's ‘Evolution of Literature.’ Very illuminating are books in which certain phases and currents of literature are correlated with a particular social milieu or with corresponding movements in Art and Culture, as in Stephen's ‘English Literature and Society,’ or in Taine's ‘Philosophie de l'Art.’ The principle of literary valuation involves questions as to the absolute or relative validity of æsthetic standards and offers splendid opportunities for the student of comparative literature. The natural reaction in æsthetic questions is the naive expression of likes and dislikes or the judicial attitude, whereas continued training and reading in a comparative spirit is bound to develop a sense of relativity of literary and æsthetic values and thus to save us from the tyranny of one-sided, absolute norms of taste. The literary movements of the last four centuries from the manifesto of the French Pléiade down to the claims of the Naturalistic school, took in most cases the form of revolts against æsthetic or intellectual absolutism of some description, and while they often ended by enthroning a new dogma in place of the discarded one, yet they helped immensely to widen the horizon and to foster the spirit of tolerance. Among modern critics the Dane, Georg Brandes, leads by far with regard to breadth of taste and fairness of judgment. He has a marvelous ability to project himself into literary characters and productions of all kinds, countries and ages, and yet to establish a definite centre of interest and an illuminating principle of interpretation. A third group of problems fall under the head of the law of causation, such as literary sources, borrowings, influences, adaptations, etc. If carried to an extreme this method develops the type of the philological antiquarian or fanatic source-hunter who is not happy until he has traced every effect back to an external cause. The mistake made in so many cases is to assume influences or definite relations, where it would be safer to speak of parallels or analogies, in other words to work with the principle of causation instead of correlation. The comparative study of literature ought to encourage critics and scholars to have more faith in the spontaneity of literary growth and originality of the human mind, instead of looking always for derived inspiration. The Marivaux-Richardson controversy illustrates the various possibilities of interpreting a literary parallel as conscious imitation, as a play of chance or as an analogy due to similar literary impulses in England and France. A collection of literary analogies which could definitely be proved to fall outside of the principle of causation would be one of the most grateful tasks for comparative analysis and might for a while dampen the enthusiasm of our source-hunters.

4. Definition.— A brief survey of the subjects and principles of a comparative study of literature will be quite sufficient to demonstrate the difficulty, if not impossibility, of giving a brief satisfactory definition. There will always be wide differences of opinion among scholars with regard to the real nature, province and purpose of Comparative Literature, while in the popular mind the term will probably continue to call up a more or less vague conception of a philosophical, speculative or at any rate broader treatment of literary problems. Strictly speaking, the comparative method is not at all on a level with other methods, but has to be regarded as one of the fundamental principles or instincts of scientific investigation in all forms and fields. It has as its natural opposite the isolating method. Specialization, concentration and isolation would be found on one side, generalization, expansion and correlation on the other. Any subject in any field of research may be treated either by isolating the problem or by introducing analogies and collateral material. It is self-evident, however, that, in the first place, scholars will differ widely in the choice of their methods and that, secondly, different subjects require different treatment in order to yield the best possible results. Biographies like Brandes' 'Shakespeare,' Woerner's 'Ibsen,' Campbell's 'Holberg,' Lafoscade's 'Musset' are written in a comparative spirit, without belonging to the field of Comparative Literature proper. Perhaps the comparative treatment of the lives of great men will become gradually recognized as a special type of biography. The phrase "Comparative Literature" ought to be reserved for research or criticism which is conducted on the basis of comparisons, influences and analogies for the purpose of interpreting international or interindividual relations in terms of literary evolution, valuation or causation.

5. Comparative Literature as Related to Universal and World Literature.—These three terms are often used interchangeably whereas they represent three different aspects of literary study. Universal or general literature refers to the sum total of all literatures and, as a literary study, expresses rather a broad, catholic attitude of the reader or scholar toward his subject than any particular purpose or method of research. Among the publications in this field may be mentioned Loliée's 'Short History of Comparative Literature,' because the title is altogether misleading; the book is merely an aggregate of national literatures with occasional cross-references. The term "World Literature" may be employed either to include recognized representative writers of all countries and ages, or a selected list of writers from all literatures varying according to the subjective taste of nations and individuals. Moulton's 'World Literature' and R. M. Meyer's 'Weltliteratur im zwanzigsten Jahrhundert' are books of this kind in which selected writers or writings are focussed to the eyes of English or German readers. Several German publications, like Baumgartner's and Busse's histories of 'Weltliteratur' are in reality handbooks of universal literature. The well-known series 'Periods of European Literature,' ed. by Saintsbury, gives cross-sections of the leading movements, arranged geographically, but treated in a somewhat comparative spirit.

Bibliography.— The most indispensable book is the bibliography by Betz, P., 'La Littérature comparée' (2d ed. by Baldensperger, F., Strassburg 1904). Many valuable references and critical remarks are found in Gayley-Scott's 'Introduction to the Methods and Materials of Literary Criticism' (Boston 1899). More recent articles on definition and theory: Gayley, Ch. M., "What is Comparative Literature" (*Atlantic Monthly*, Vol. XCII, July 1903); Routh, H. V., 'The Future of Comparative Literature' (*Modern Language Review*, Vol. VIII, January 1913). Courses in Comparative Literature are offered at the larger American universities, though many of them would come rather under the head of General Literature. The most valuable contributions will be found in the publications of the Modern Language Association of America, in *Modern Philology* and in the *Modern Language Review*.

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LITHIA, in chemistry, oxide of lithium (q.v.).

LITHIA MICA. See LEPIDOLITE.

LITHIC ACID. See URIC ACID.

LITHIOPHILITE or **TRIPHYLITE.** A mineral consisting of phosphate of lithium, manganese and iron, Li (Fe Mn) PO_4, of salmon to honey yellow color. Occurs in southern California and Black Hills of South Dakota. A possible source of lithia salts.

LITHIUM, a name applied to an alkali discovered in the year 1817. Lithia has since been detected in spodumene, lepidolite, triphylite, amblygonite, tourmaline, meteoric stones, mineral waters, coffee, tea, blood, milk, etc. A process for procuring it is the following: One part of petalite or spodumene in fine powder is mixed intimately with two parts of fluor-spar, and the mixture is heated with three or four times its weight of sulphuric acid, as long as any acid vapors are disengaged. The silica of the mineral is attacked by hydrofluoric acid, and dissipated in the form of fluosilicic acid gas, while the alumina and lithia unite with sulphuric acid. After dissolving these salts in water, the solution is boiled with pure ammonia to precipitate the alumnia; is filtered, evaporated to dryness and then heated to redness to expel the sulphate of ammonium. The residue is pure sulphate of lithium. Its color is white; it is not deliquescent, but absorbs carbonic acid from the air; it is soluble in water; it is acrid and caustic, and acts on colors like the other alkalis; heated with platinum it corrodes it rapidly. It combines with the different acids, and forms crystallizable salts with them. The phosphate and carbonate are sparingly soluble; the chloride is deliquescent and soluble in alcohol, and this solution burns with a red flame. Unlike the other alkalis it cannot be reduced from its carbonate by carbon, but it requires the action of a galvanic battery. The compound employed is the chloride, which, while in a state of fusion, is acted on by the battery. Small globules collect round the negative pole, and these are removed and cooled under petroleum. It is the lightest of metals. It has a bright silver-white metallic lustre, melts at 356° F., and can be welded at ordinary temperatures. It is rather harder than potassium, can be drawn into a wire, but has a low degree of tenacity. Exposed to the air it tarnishes, but it combines with oxygen less rapidly than either sodium or potassium. It decomposes water, and when heated in oxygen, chloride and other gases burns with a brilliant light.

Compounds of lithium are used in pyrotechny on account of the splendid red color they impart to flame. In medicine the carbonate is employed especially as a solvent for uric acid, to prevent the formation of calculi and to remove it from the system in gout. Effervescing lithia water is sometimes used in place of soda or potash water. Citrate of lithia is also employed. It is a white, soluble, crystalline salt, prepared by dissolving the carbonate of lithium in citric acid. Its therapeutic properties are similar to those of the carbonate. See MINERAL PRODUCTION OF THE UNITED STATES.

LITHOGRAPHIC CRAYON. See LITHOGRAPHY.

LITHOGRAPHIC STONE. See LITHOGRAPHY.

LITHOGRAPHY. (Greek lithos, "stone," and graphein, "to write"), may be divided into two distinct branches — the art of writing, drawing or engraving on stone, and the process of chemical or surface printing from stone or metal, by means of which such writings, drawings or engravings are multiplied, in a manner differing essentially from letterpress or relief printing and from steel and copper plate or intaglio printing. Lithographic printing is based upon the physical principle of the antagonism of grease to water and upon the porous nature of the printing surface. By virtue of this property, a drawing made upon such surface with unctuous ink or crayon will adhere to it so that the parts of the surface containing the drawing or design will accept and hold grease or ink, and those parts of the surface free from design will receive and retain water to the evaporating point. Thus if a roller covered with fatty printing ink is passed over the printing surface previously moistened, the ink will adhere only to the parts constituting the design and will be repelled by the moisture covering the remaining part of the surface, in consequence of which the design only will appear in the impression.

History.— Aloys Senefelder is generally conceded to be the inventor of lithography. He was born at Prague in 1771, the son of an actor, and at an early age removed to Munich. Although disposed to follow his father's calling he entered the university at Ingolstadt, which later, through the death of his father he was compelled to leave and was thrown on his own resources for a livelihood. He met with indifferent success as an actor, and later, as a playwright, his inability to pay for the publication of his work bestirred him to devise some means of doing it himself, and he set about to become familiar with the printing art. He purchased a small press and being unable to pay for the engraving of his compositions, he turned his attention to etching on copper. Frequent errors through his inexperience in forming the reversed characters on the plate, and being unfamiliar with the "stopping out" so-called solution used by etchers in rectifying mistakes, he succeeded in devising one of his own. The ingredients he used were those nearest at hand — the wax with which he coated the plates previous to etching, the soap with which he washed the ink from the plates, and the lamp-black which he used in preparing his ink for printing. Thus accidentally he discovered the composition which forms the basis of all crayons and lithographic drawing inks. The labor of grinding and repolishing the copper plates led him to experiment with a piece of Kellheim stone and by treating this in the same way as the copper plates he succeeded in getting fair impressions. He later reversed the etching process by writing on the stone with the "stopping out" composition and biting down the surface with aqua fortis, bringing out the characters in relief, which he inked in and printed in the manner of type. He further discovered that relieving the characters was unnecessary and that by simply writing on the stone with his composition he produced the same results. This was in the year 1798; eight years later, after many disappointing and discouraging experiences, the inventor succeeded with the assistance of the Bavarian government in establishing himself as a lithographic printer in Munich. This city became the centre of the art, and three years thereafter no fewer than seven separate concerns were established as well as a number of private presses. Senefelder died in 1834, and with the possible exception of the introduction of photography the general methods and underlying principles he laid down are those in use to-day.

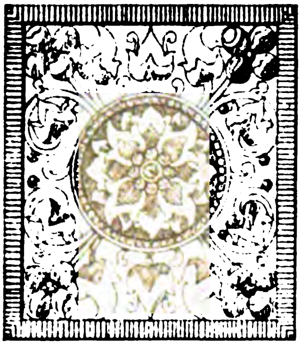
Of the early lithographers many others are entitled to credit, they having done much to develop and foster the craft. Ferdinand Pilotti in 1808 published 432 copies of the old masters, and in 1815 reproductions from the Munich gallery. His partner, Lochle, was also conspicuous in the early development of lithography, as well as Count Lasterie, who introduced the art in Paris. It fell to Gottfred Engelmann to found the first permanent establishment in Paris in 1816. In 1837 he was granted letters patent on the invention of chromo-lithography. The first house in Berlin was established in 1834 by Franz Hanfstangel, and in London in 1822, by Hullmandel, a pupil of Engelmann. Senefelder also attempted to establish himself in London but failed owing to difficulties with his partner, Andre of Offenbach.

Lithography as an art reached its climax in Paris during the reign of Louis Philippe. Among the masters who distinguished themselves were the satirists Daumier, Grandville, Travies and Gavarni, Deveria, Delacroix, Johannot and Gigoux, the delineators of romantic literature; Charlet, and Raffet, who found material in the glorification of Napoleon's career. Other painter-lithographers of the day were Géricault, Richard Park Bonington, James Duffield Harding, Eugene Isabey, Alexandre Calame and Julien, whose "Etudes en Deux Crayons" made him famous. Since the introduction of the power-press and the consequent development of the lithographic industry as a commercial factor, the medium of lithography has found less favor as a mode of individual artistic expression. Commercially it has grown to be one of the most important

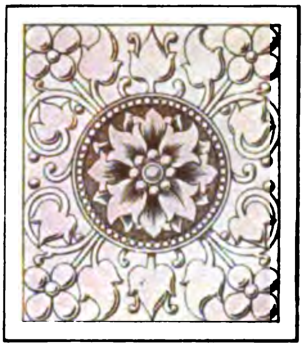
[illegible]

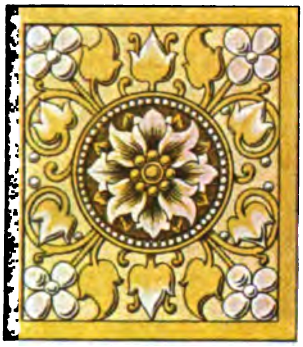
LITHOGRAPHY

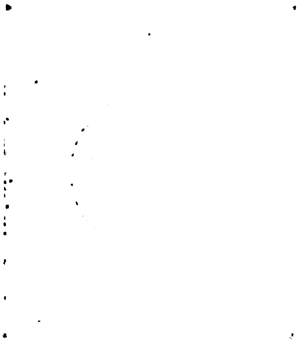
Plates and Printing required for Design of Six Colors

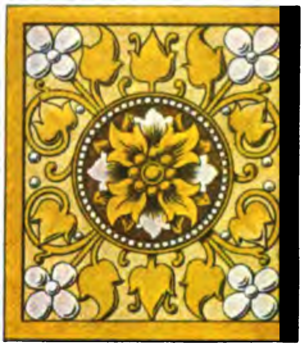

1. Outline of Design

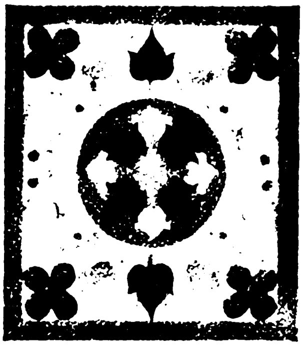
2. First Color Plate

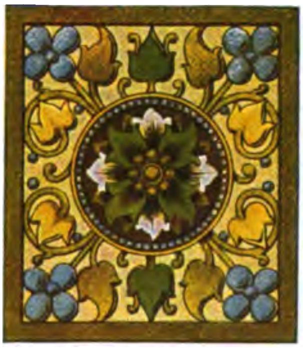

3. Second Color Plate

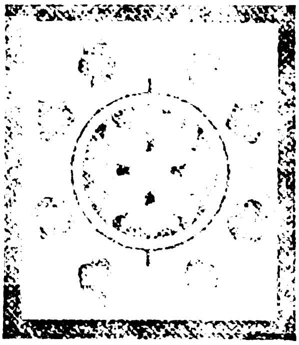

4. First and Second Color Plates Combined

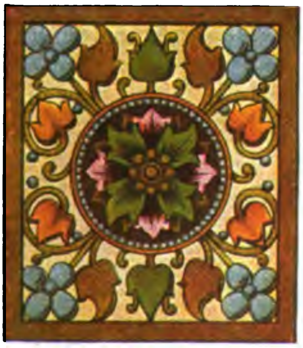

5. Third Color Plate

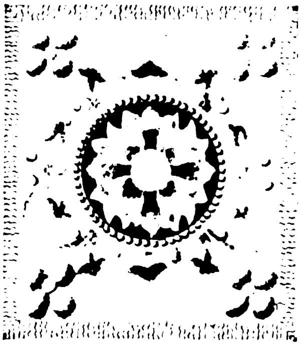

6. Combination of Three Color Plates

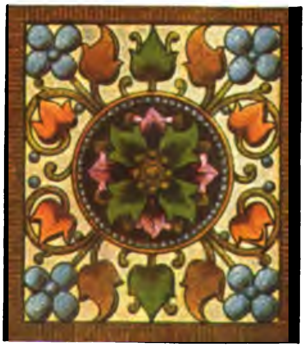

7. Fourth Color Plate


8. Four Color Plates Combined


9. Fifth Color Plate


10 Five Color Plates Combined


11. Sixth Color Plate


12. Printing Complete in Six Colors

branches of the printer's craft. The Department of Commerce, census of manufactures for 1914, published in 1917, gives the number of establishments 336, employees 15,171, invested capital $36,685,000, and value of annual product $25,119,000.

Materials.— The stone used, known as "lithographic stone," is a compact, homogeneous limestone of porous texture and varies in color from light cream, dull yellow, drab or gray to darker shades of the same colors, the best being found among the light gray varieties. The darker the color the harder the stone. Lithographic stone is quarried chiefly at Solenhofen, Germany, from beds of Jurassic Age, and while similar stone has been found in England, France and America, none possess the quality of the Solenhofen product. The most satisfactory American product is said to come from Brandenburg, Ky. It is sawn at the quarries into slabs of from three to five inches in thickness, varying in size from 6 × 8 inches to 44 × 64 inches, and is sold by weight. The price per pound being based on quality and size, the very large stones when free from blemishes such as veins and chalk spots are the most expensive and very scarce. Owing to the expense incurred in handling and storing the cumbersome stone, a substitute embodying the same properties has been the desideratum of lithographers almost since the invention of surface printing. Zinc has been in use for 50 years or more, but up to 10 years ago was used only for very ordinary work. Since that time it has come into considerabe use for offset lithography (described later). Aluminum has been satisfactorily used as a substitute for stone for about 20 years and for some purposes is preferable to zinc as a substitute.

Lithographic crayon is composed of beeswax, shellac, tallow, mastic turpentine, soap and lampblack in several degrees of hardness. Lithographic ink adapted for pen work on stone contains the same ingredients as the crayon, with a larger quantity of the soap, in order to make it soluble in water. The ink is furnished in sticks and rubbed over a plate or saucer and then gradually dissolved with water or turpentine until it becomes fluid. Gum arabic and acids are important factors in lithography; in fact, Senefelder's original invention would have proven of little practical value had he not also discovered the use of these in reinforcing the qualities of the stone.

Process.— The stone is first leveled and if desired for crayon work the surface is grained by grinding with fine sand and water between two slabs of stone until its surface has a grain similar to the grain on fine drawing paper. For pen or stipple work the stone is polished with pumice or scotch stone. The drawing is made on the stone in the same manner as if it were drawn on paper, except that the design is reversed. Considerable experience is required by the artist to obtain proficiency in rendering a reverse facsimile of the original. In the hands of a capable artist no reproductive art can offer greater possibility than that of crayon on a grained stone. It permits greater freedom as compared with steel, copper plate or wood engraving, inasmuch as technique is less important than true artisticability, while an infinite variety of tones, from the most delicate shade to rich, deep black, lies within its possibilities. Somewhat more mechanical is the pen stipple manner, and which as its name implies consists of drawing with small dots, the relative values of shading being determined by the varying density of the dots. This manner is employed mainly in chromo-lithography, its chief recommendation being the clean, sharp, solid nature of the work.

When the drawing is completed, its surface is treated with a solution of gum arabic and nitric acid, effecting a chemical change in its nature where it is not protected by the grease or ink of the drawing. The carbon is freed and a nitrate deposited in the form of a full-grained pellicle, the pores of which retain the gummed water, thus creating a surface impermeable to grease. Furthermore the drawn parts are rendered insoluble in water by decomposing the alkali contained in the crayon or ink. The object of this etching is not to elevate the drawing so much as to make the impression cleaner and sharper.

After the stone is etched, it is washed successively with water and turpentine; the design is scarcely perceptible, but after repeated moistening and rolling in with ink it reappears and accepts the ink. It is then covered with a weak solution of gum arabic and is ready for printing.

The stone-engraving manner — used extensively for bank notes and stationery — is based on the same principle, although the mode of procedure differs in every respect. A polished stone is used and its face is prepared or etched with gum-water acid and covered with a dark ground consisting of lampblack in solution with gum-water or albumen. Into this ground the design is engraved or scratched with an engraving needle or a diamond. Linseed oil is then poured over the whole and is absorbed by the stone where the needle has laid it bare. The ground is washed off, the surface moistened and printing ink rubbed in with a tampon or dauber, the ink adhering only to the lines of the design, by reason of the oil which they have absorbed.

The greatest achievement of lithography undoubtedly centres in reproduction of oil paintings and aquarelles, commonly known as chromo-lithography. Either the crayon or pen stipple manner alone, or both together, in connection with other manners, such as "rub-tints," "asphalt tints," etc., are brought into the work. Its most simple form is the tint used for crayon drawings, its highest, the reproduction in colors of an oil or water color painting, requiring a series of drawings on separate stones, one for each of the colors necessary to produce the facsimile. To obtain perfect register of the various printings, a key plate is necessary. A detailed tracing is made of the original by means of an engraving needle, scratching the surface of a sheet of transparent gelatine or celluloid, indicating the boundaries of even the most minute patches of color. These engraved lines are charged with lithographic ink and then transmitted to stone by pressure. Register marks (usually crossed lines) are then put in the margins. The stone is etched, rolled up with printing ink, and impressions corresponding to the number of colors or printings required, are pulled. These impressions 'are then powdered with finely ground powder (usually Venetian red) and are called «offsets,» which are then transmitted to the surface of the stones to be drawn on and furnish a guide for the artist in drawing his color plates. In cases where no key of the original is made, offsets from the drawing of the black supplied with the necessary register marks answer the same purpose. The number of colors necessary to produce a given result varies largely according to the nature of the original to be reproduced, ranging for commercial purposes from 3 to 15, although especially fine results may require 20 or more.

Photography.— Since its invention photography has been more or less allied with the lithographic art. Its early application was the process called photo-lithography, by means of which pen or line work or reprints from type could be inexpensively transferred to stone or plate. The half tone or Meisenbach process was also used to advantage in furnishing key plates for chromo-lithography, but the introduction and development of the offset press, which was made possible through development of rotary printing from plates instead of stone, has greatly enlarged the use of photography, opened entirely new fields and possibilities in the art of color reproduction, and has caused an immense expansion of the lithographic industry. One of the earliest photo-lithographic processes is that of Lemercier, patented in 1852, which is based on the sensitive property of asphaltum, discovered by Niepce in 1833. A lithographic stone is coated with a solution of asphaltum in oil of lavender and exposed to light under a half-tone screen negative, the film of which has been turned on the glass to secure the necessary reversed position, effecting a slow change in the asphaltum. The parts thus affected by the light become insoluble in turpentine, leaving the other parts soluble. Thus a (reversed) positive is rendered on stone, which, owing to the unctuous nature of its composition, can be prepared for printing purposes in the usual manner. The method most commonly used is the albumen process, invented by Poitevin in 1855. In this case the stone is coated with albumen in solution with bichromate of potassium which is much more sensitive to light action than asphaltum; after exposure the stone is immediately covered with printing ink to prevent further action, and washed with water which removes the parts that remain soluble, while the ink adheres only to the parts that have become insoluble.

The same general principles apply where plate instead of stone is used, with variations of solutions and methods for the preparation of the plate, the developing and reversing of the design.

The perfection reached in printing half-tone work on the offset press has made possible the faithful reproduction of almost any color subject, through the use of color sensitive or collodion emulsion photographic plates, usually three plates, one for each of the primary colors, yellow, red and blue, which when properly developed give color-separated negatives which are then printed on the plate in the usual manner. For variations of the primary colors the plates are either over or under printed and after development are carefully worked over by the artist adding to or taking from the work as desired.

Transferring.— Unless limited editions are required, designs that have been drawn or engraved on stone are very rarely printed from directly. By the process of transferring, one design may be reproduced as many times as the relative size of the work and sheet to be printed will allow — ensuring greater economy in printing and keeping intact the original drawing stone. Transfer impressions are taken on a paper, coated with a sizing of starch and glycerine with a specially prepared ink. These impressions are laid in their proper positions on a sheet of paper of the required size and fastened to it by means of pricking with the dull point of an engraving needle. The sheet to which the transfers adhere is laid face down on a polished stone or plate and pulled through a hand press until the transfers adhere firmly to the stone, the paper being frequently dampened during this process. This done, the sheet is carefully raised from the stone, leaving the thin paper transfers still adhering to its surface and these in turn are dampened and removed. A weak solution of gum and water is applied and the stone rolled up with printing ink. It is then etched in the same manner as an original drawing and is ready for the press. In chromo-lithography the first transfer made is that of the key plate, supplied with register marks. An impression from this transfer is mounted on a sheet of aluminum or zinc and coated with shellac to prevent shrinking or stretching. All succeeding transfers are «stuck up» or fixed on this key sheet, which ensures accurate register of the colors.

Lithographic Printing.— The lithographic hand-press consists of a frame provided with rollers on which the bed runs to and fro, the scraper or impression-bar and a tympan of leather, fitted to an iron frame hinged to that end of the bed nearest the scraper. The scraper consists of a flat piece of box wood beveled on both sides and covered with leather. The manner of printing is as follows: The stone with the design upon it is placed face up upon the movable bed, then moistened with a sponge, rolled up with ink and the sheet which is to take the impression laid thereon. Several sheets of paper are placed over it to secure the necessary backing, the tympan lowered upon it to cover the entire bed and stone, and the carriage brought forward under the scraper. Pressure is applied by means of a hand-lever at the side of the press, and the entire length of the bed passed under the impression bar. The pressure is then released, the bed brought back to its original position, the tympan raised and the printed sheet taken off. Until the introduction of the power-press in 1867 this method of printing was exclusively used for lithographic printing. At the present time its only utility is for the purpose of making artist-proofs and transfers for printing on power-presses. The lithographic flat bed power-press differs but slightly from that of the typographic power-press. The principle of operation remains the same, taking in place of the letter-press form a lithographic stone in its bed and being supplied with a contrivance for distributing the moisture with which the stone must be covered before the ink is applied. The use of rotary printing presses, with an increased speed of 50 per cent over the flat-bed presses, has been made possible by the substitution of the flexible aluminum plate for lithographic stone, and has enlarged the field of multi-color printing by the lithographic process, whereby two or more colors are printed in rapid succession before the sheet is delivered. The rotary press consists principally of two cylinders — one to hold the plate and the other to furnish the pressure — and is supplied with a mechanism similar to that of the flat-bed press for distribution of moisture and ink. Rotary presses having two, three and four plate cylinders and printing respectively two, three and four colors each time a sheet is fed are in general use. The presses described above all print by direct contact from the stone or plate to the paper, whereas the offset press, a very important development in modern lithography, prints from the plate to a rubber blanketed cylinder, which in turn prints on the sheet. These presses are built on the same general principle as the rotary press but having three cylinders, one to carry the printing plate, another to carry the rubber blanket and a third to carry the sheet which takes its impression from the rubber blanket. Provided with automatic feeding apparatus, a production double the rotary presses is possible. They produce wonderfully soft effects on rough or uncoated papers being in fact the only method whereby half-tone color subjects can be printed on other than the highly glazed or coated papers.

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LITHOLOGY. See Petrology.

LITHOSPHERE, the solid rock crust of the earth as contrasted with the waters, hydrosphere, and the air, atmosphere. See Rocks and also section on *Geognosy* in the article on Geology.

LITHOTOMY, *in surgery,* the operation of cutting for stone. (See Calculus). As usually performed it consists in cutting by the side of the anus in the perinæum, so as to reach and divide the urethra and neck of the bladder, where it is surrounded by the prostate gland. A grooved and curved staff is introduced into the bladder first, and then the incision is made in the perinæum to reach the bladder, the groove in the staff serving as a guide to the knife. When the calculus or stone is felt with the finger the staff is withdrawn and the stone extracted, by means of forceps, proper treatment to ward off inflammation and other accidents being then adopted. When thus performed, unless there be unusual difficulties, the length of time required to extract the stone is seldom more than three minutes, often one or one and a half. At first the urine escapes through the wound, but in favorable cases it issues by the natural passage within a week, and the wound heals in the course of a month.

LITHOTRITY, *in surgery,* the operation of crushing a stone in the bladder into fragments of such a size that they may be expelled by the urethra. The instrument is called a lithotrite, by which the stone is broken up. It is introduced in the same manner as a catheter or sound into the bladder, and after catching the stone crushes it to pieces. The instrument has two movable blades at the extremity introduced into the bladder, and these are brought together to crush the stone by means of a powerful screw. This operation is only applicable where the bladder is not irritable, where the canal of the urethra is of good size and the stone small. It is inapplicable to children, but this is the less to be regretted, because there is perhaps no surgical operation more generally successful than that of lithotomy in children. In lithotrity care must be taken that no portions of the stone are left in the bladder, as such fragments are almost certain to form the nuclei of fresh concretions.

LITHUANIA, lĭth'ū-ā'nĭ-ạ (Letuva), a region in eastern Europe situated between 52° 30' and 57° 45' N. and 20° 50' and 28° 20' E. About 63,000 square miles of Lithuania proper belonged (in 1914) to Russia and formed the governments of Grodno, Minsk, Moghiler, Vilna and Vitebsk; while about 6,500 square miles belonged to the kingdom of Prussia. Thus the whole territory is bounded by Courland on the north, Poland on the west, Russia on the east and a portion of the Ukraine on the south. According to Lithuanian claims made in 1918 their territory is described as consisting of some 13,500 square miles of eastern Prussia with over 7,000,000 inhabitants (mostly Germans), and 131,000 square miles of Russian soil with a population of over 11,500,000 (Russians, Poles, Lithuanians and Jews), including the towns of Königsberg, Memel, Libau, Windau and Riga. The total purely Lithuanian population is estimated at about 2,000,000. Thus, while Lithuania proper is generally regarded as the region between the Lower Dvina and the Niemen, the historical-geographical name is applied to a far larger area. The Lithuanians were tributary to Russia in the 11th century, but gained their independence when Russia was distracted by the troubles under the successors of Vladimir. Ringold, in 1235, bore the title of grand-duke, and under his successors the whole of Russian Lithuania became independent. At that time (during the 13th century) the Lithuanians, hemmed in between the Slavs and the Germans, were also confined between two civilizations — Oriental and Occidental — Greek Christianity on the one side and the

Roman Church on the other. Though lacking natural frontiers, they not only maintained their national existence and customs, but even extended their dominions to the Black Sea. Ringold (or Ryngald) gained several victories over the Mongols and stopped their advance into western Europe. His successor, Mindaugis, fought against the Russians, the Poles, the Sword-Bearers and the Teutonic Knights. He appealed to the Pope for aid against the Knights, was baptized in 1252 and defeated his enemies in 1261. Two years later he was murdered. His sons drenched the soil with blood in revenge upon the murderers, and the country fell into a 20 years' anarchy. The real founder of Lithuanian power was Gediminas (1315–40), head of the Jagellans dynasty. He ruled the country wisely and formed alliances with western Europe. He arranged with the Pope to establish Christianity in Lithuania, but German intrigues prevented the plan. One of his sons, Algirdas (1345–77), defeated Teutonic Knights, Poles, Tartars and Muscovites, marched three times to Moscow and even invaded the Crimea. Jagello, son of Algirdas, by his marriage with Hedwige, united Lithuania with Poland and succeeded in establishing Christianity. At the time of the union with Poland (1386), Lithuania included the basin of the Niemen and of its tributary, the Neris, with Vilna as the metropolis; Samogitia (Zemaitiga); White Russia: the ancient principalities of Polotsk and Vitebsk; Black Russia, with Kiev, Chernigov and Perejaslav; and Volynia and Podolia, with Brest-Litovsk, Lutsk and Cherson. Though forming the largest European state at the time, the Lithuanians lacked unity; the country was split between the Greek and Roman Catholic creeds. By the «Political Union» at Lublin in 1569 Lithuania and Poland became more closely united under one head, with the proviso, however, that each country should retain its own laws, army, chancellor and other dignitaries. The «Polonization» of the country was inevitable, the Lithuanians being in a minority. But the «union» produced only disunion, internecine, strife and anarchy. Instead of having two armies, they had none, and in consequence the three partitions of Poland-Lithuania by Russia, Prussia and Austria were easily accomplished in 1772, 1775 and 1779. Poland was cut up between Russia, Prussia and Austria, and the two former shared Lithuania between them. In 1840 an imperial ukase abolished the name of Lithuania; the process of «Russification» was carried through with bloody repression. The Latin alphabet was prohibited and many thousands of Lithuanian books were burnt by government orders. It was not till 1904 that the former persecution regulations were repealed by Russia.

That part of Lithuania under Prussian dominion enjoyed better treatment at first. The kings of Prussia favored and protected the people. A chair of Lithuanian language and literature was established at Königsberg University. Since the days of Bismarck, however, things have changed; the Lithuanian language has been suppressed and the people have been «Prussianized» with but little effect. In the early stages of the European War the Russians overran the Lithuanian part of East Prussia, but the victory of Hindenburg in the Mazurian Lakes region led to the German invasion of the Baltic provinces, while the whole of the great Polish salient also fell to the Germans. Russia having alienated Lithuanian sympathies, the people welcomed the German invaders in 1915. While recognizing Lithuanian sovereignty in 1916, the German government would not acknowledge the independence of the country. During the war the general movement for liberation among the subject races of Russia, Germany and Austria-Hungary revived the smoldering national sentiment of the Lithuanians. They formed a State Council and pressed their claims for independence and for political union with their half-brothers, the Letts. In 1916 they appealed to President Wilson for recognition of sovereignty, though the country was in German possession at the time. A convention of Lithuanian delegates assembled in Vilna in October 1917 and adopted a resolution demanding independence. At a similar gathering in the same place that independence was proclaimed by the delegates in January 1918. On 23 March the council announced that it advocated a permanent relation of alliance with Germany. Four months later (July 1918) the Lithuanian bureau of information in Switzerland revealed that the council proposed to offer the crown of Lithuania to the Duke of Urach, a lineal descendant of the ancient Lithuanian dynasty and an officer in the German army. But already in March a convention of American Lithuanians held in New York had declared for a republic and advanced the territorial claims referred to above. The inspired German press denied that the council had power to form a state without conforming to German interests. Early in May 1918 it was announced in the American press that a Lithuanian deputation had been received by President Wilson. The end of the war on 11 Nov. 1918 and the ensuing Peace Conference at Paris in 1919 marked the beginning of a new era for Lithuania. There are said to be over 700,000 Lithuanians in the United States. See WAR, EUROPEAN.

LITHUANIAN LANGUAGE AND LITERATURE.— The Lithuanian language is more ancient than Greek, Latin, German, Celtic and the Slav tongues. It belongs to the Indo-European group and is the nearest idiom to Sanskrit. The resemblance, indeed, is so close that Lithuanian peasants can understand Sanskrit sentences pronounced by learned scholars. Hence philologists are generally agreed that Lithuanian is the most ancient of all the living languages. It is not easily possible to compare it with Arabic, the antiquity of which has not been fathomed. A remarkable feature of Lithuanian is also the fact that it has as much likeness to Greek and Latin as to Sanskrit:

Lithuanian — Virai traukite jungan;
Latin — Viri trahite jugum
(«Men drag the yoke»).

Lithuanian — Dzievs (Dievs) davé dantis, duos duonos;
Greek — Zeus dedoke odontas dosei siton.
(«God has given teeth, he will give bread»).

The invaluable service of the language to philologists was recognized by Kant (1724–1804), who was born in Prussian Lithuania and acquired a knowledge of it. In his preface to a Lithuanian grammar he wrote: «Lithuania having a royal character, deserves the protection of the state. She must be preserved, for her tongue possesses the key which opens all the enigmas not only of philology but also of history.» This statement was scientifically supported and confirmed by the great philologist Schleicher in his work on that language, while Reclus, in his monumental 'Géographie Universelle,' says: «If the value of a nation in the whole of humanity were to be measured by the beauty of its language, the Lithuanians should rank first among the inhabitants of Europe.»

Lithuania had no writers at the time of her existence as a great state. Traditional songs, poems and legends were chanted by itinerant *burtininkas* or national bards. About the 16th century they ceased to exist owing to clerical persecution, and their songs died with them — they are lost. The bards differed from the minstrels of other countries and races in that they glorified no heroes real or legendary: they sang only dirges for the dead, the so-called *raudas*. A popular style of lyric singing with musical accompaniment is the «daina,» mild and tender in spirit, simple and resigned, breathing resignation in grief and devotion to patriarchal customs. There is in them nothing of the slashing, fire-eating bravado that distinguishes most of the ancient ballads of love and war. If the soul of a nation is revealed in its songs, then the Lithuanians deserve to be classified as the most harmless, peaceful race in the world. Even the German poets Goethe and Herder are said to have borrowed inspiration from the Lithuanian «dainos,» of which many thousands exist, adapted to all phases of life excepting war.

During the Reformation religious literature, written by Jesuits, made its appearance in Prussian Lithuania. The oldest book in the language was a catechism translated from the German and dated 1547. Until the 18th century only translations of the Bible and other devotional works existed in Lithuanian, when the fine national epic poem, 'Metas' (The Four Seasons), by Duonelaitis (1714–80) was published. The three leaders in the national revival were Daukantas, Poszka and Bishop Valanczevskis. The first wrote a number of literary and historical works, among which the most important are 'Lietuvos Istorija' (History of Lithuania) and 'Budas Lietuviu Kalnenu ir Zemaitiu' (Character of the Lithuanian Highlanders); the second produced many poems and translations; and the bishop wrote a history of the introduction of Christianity into Samogitia. During the first half of the 19th century the national literature progressed favorably if slowly when the Russian government intervened in 1864 and ordered the Latin type hitherto used to be replaced by Russian characters. Proscribed in Russian territory, the printing presses were removed to Prussian Lithuania, where books and papers were printed (mainly at Tilsit) and smuggled across the borders to the Lithuanians under the Tsar's rule. Since that time some notable additions have been made to the literature, though it can hardly claim a prominent position as yet. The majority of later writers devoted themselves to poetry — the national favorite. Kudirka wrote 'The Bells of the Fatherland' and the hymn 'Lithuania our Country' (Lietuva tevyne musu). The highest rank in the modern school was reached by the dramatic poet, Vidunas, who wrote a trilogy, 'The Shadows of Ancestors,' the force and beauty of which has been favorably compared with Shakespeare's work. The poet and publicist, Jaksztas, conducts his own review, *Draugija,* in the columns of which his original works make their first appearance. Quite a number of women writers have added to the modest total of the budding Lithuanian literature: Rogana, Peleda, Bite-Petkevicz, Lazdynu, Zemaite and Szatrijos. The famous Polish novelist, Henryk Sienkiewicz (d. 1916) was of Lithuanian origin, as also was the patriot Kosciuszko. Political repression and lack of educational opportunities have hitherto hampered the development of both language and literature in the past. The law of 1905 permitted the introduction, during the first two years, of the Lithuanian language in schools where the teaching was exclusively Russian. All the higher schools have been abolished and elementary education is not compulsory. Beyond a few native societies which promote popular lectures, there is no facility whatever for adult education. Two such societies were broken up by Russia as recently as 1908. Consult Gabrys, Jerzy, 'Sketch of the Lithuanian Nation' (Paris 1911).

LITITZ, lĭt'its, Pa., borough, in Lancaster County, on the Philadelphia and Reading Railroad, about 28 miles southeast of Harrisburg, and eight miles north of Lancaster. The first permanent settlement was made in 1757 by Moravians. Some of the United Brethren had formerly lived in Bohemia and they named the place after their old home. They showed their loyalty to their new country by providing shelter, food and care for wounded soldiers of the Revolutionary War. The graves of some of the early patriots are still pointed out. Lititz is situated in a region where there are many good farms, but its chief industries are in manufacturing. The principal manufactures are corn-starch, knit-goods, planing mills, animal traps, shoes, box board, paper, liquor, pretzels, cocoa, chocolate, cigars and some dairy products. The mineral springs are noted and much frequented. The borough is the seat of Linden Hall Seminary, established in 1794. Pop. 2,082. Consult Mombert, 'History of Lancaster County, Pa.' (Lancaster 1868); 'Moravian Historical Society Records' (Vol. II, Bethlehem, Pa.).

LITMUS, or **LACMUS,** is a blue pigment obtained from any lichen which yields archil. (See LICHENS, *Fungi*). The plant, bruised between stones, is exposed to the air for several weeks, and moistened with some liquid containing ammonia, lime and potashes being also added. Fermentation sets in, the lichens becomes red and finally blue, and when it has acquired the proper tint, chalk or sulphate of lime is added, and the soft paste is made into square cakes by pressure in molds, and the cakes are then dried. Litmus is complex in nature; it contains several coloring matters of definite composition, which can be separated by the use of glacial acetic acid and absolute alcohol.

LITOLFF, lĭt'ŏlf, **Henry Charles,** European composer and pianist: b. London, 6 Feb. 1818; d. Paris, 6 Aug. 1891. He studied pianoforte playing under Moscheles, and made his first public appearance as a pianist at the Covent Garden Theatre, London, in 1832. At 17 he went to France and for some time lived a wandering life, traveling in France, Holland and Germany, giving concerts. In 1851 he settled in Brunswick, married the widow of the music-publisher Meyer, and took control of the business. Later he transferred the management of affairs to his adopted son, who began the publishing of cheap editions of classical music. In 1860, after the death of his wife, he moved to Paris, and married the daughter of the Count de la Rochefoucauld. His compositions include piano pieces (including the 'Spinnlied'); symphony concertos; and the operas 'Heloise et Abelard'; 'Die Braut von Kynast'; 'Les Templiers,' and 'King Lear.' As a pianist he showed feeling and was brilliant of execution, but uneven, and sometimes inaccurate.

LITOPTERNA, a group of extinct South American hoofed animals of the order *Toxodontia*, herds of which pastured on the Argentine pampas during the whole Tertiary Period. It has been thought that these animals should be merged with the Perrisodactyla, but the later view is that they present a case of convergence, fulfilling on the plains of South America the rôle of the horses in North America; yet not all of the Litopterna were horselike. In the Miocene and Pliocene two very distinct families existed within this order — the Macrauchenidæ and the Proterotheriidæ. The former were grotesquely camel-like, the early forms (as Thesodon) having much the size and shape of a llama, with a remarkably long snout, while their later descendants (Macrauchenia) resemble long-necked, heavily-built camels whose nose had developed into a real trunk nearly as long as the skull. The legs were long and stout and the feet had three toes, but in structure the foot was not like either the camel's nor the horse's. This queer, composite creature is believed to have obtained its living by browsing on trees.

LITORINA. See PERIWINKLE.

LITRE, lē'tėr, or **LITER,** the French standard measure of capacity in the decimal system. It is a cube, each side of which measures 3.937 inches, and it contains 61.02 cubic inches, or 1.056 quarts. See also METRIC SYSTEM.

LITTELL, lĭ-tĕl', **Eliakim,** American publisher: b. Burlington, N. J., 2 Jan 1797; d. Brookline, Mass., 17 May 1870. He learned the printer's trade, and in 1819 established at Philadelphia a literary periodical, the *National Recorder*, the name of which was changed in 1821 to the *Saturday Magazine*. In 1822 he began to publish a monthly, the *Museum of Foreign Literature and Science*, giving selections from the best periodical literature of Europe. In 1844 he started in Boston *Littell's Living Age*, a weekly literary eclectic periodical which is still continued.

LITTLE BELT, The. See PRESIDENT AND LITTLE BELT.

LITTLE BLUE CREEK, a small stream in Jackson County in the western part of Missouri. A contest occurred, in 1864, on the banks of this stream, between Federal troops under General Curtis and Confederate troops under Gen. Sterling Price. The contest lasted several hours, when the Confederates fell back on Big Blue Creek, in the same county, and made a strong resistance. The Union cavalry, under General Pleasanton, finally routed the Confederates, who retreated into Arkansas.

LITTLE COLORADO, a river which has its rise in Apache County, Ariz., running northwest to its junction with the Colorado River. The amount of water is sometimes large, but again the river resembles a chain of small lakes or ponds, with dry or nearly dry river bed in many places. The river is about 230 miles long. It flows a little south of the southern boundary of the Navajo Indian Reservation, around the region where many «Cliff Dwellers» once lived in Arizona, and on through arid wastes and among low mountains to near the Colorado, where it enters a deep cañon, through which it passes into the Colorado just at Marble Cañon.

LITTLE CORPORAL, The, a name bestowed upon Napoleon by his admiring soldiery after the battle of Lodi, in affectionate allusion to his small stature.

LITTLE CROW (Chetañ wakan mañi), chief of the Kaposia division of the Mdewakanton Sioux: b. about 1810; d. McLeod County, Minn., 3 July 1863. He was a signer of the Treaty of Mendota, Minn., 5 Aug. 1851, under the terms of which the Dakota ceded nearly all their lands in Minnesota to the United States. Not satisfied with its terms he used it to spread dissatisfaction which finally burst forth in the uprising of 1862. In this outbreak, during which more than 1,000 settlers were killed, Little Crow was the recognized leader. On 20-22 Aug. 1862 he led an unsuccessful attack on Fort Ridgley, Minn., in which he was slightly wounded. After the disaster to Indian arms at Wood Lake, 23 Sept. 1862, Little Crow with about 300 followers fled to his western kinsmen. He was killed by a settler named Lampson. Consult Bryant and Murch, 'History of the Great Massacre by the Sioux Indians in 1862'; 'Indian Affairs Report' (issues of 1862 and 1863).

LITTLE DORRIT, a novel by Charles Dickens (q.v.) published in 1856. There is but slight plot to the story, which contains more than 50 characters.

LITTLE EGRET, any of several small, white herons. See EGRET; HERON.

LITTLE FALLS, Minn., city and county-seat of Morrison County, on the Mississippi River and on the Northern Pacific Railroad, about 100 miles northwest of Saint Paul. The place was settled in 1856, and in 1889 was incorporated. A dam across the river aids in furnishing extensive water power. It is situated in an agricultural and lumbering region. Its chief manufactures are flour, lumber, machine-shop products, paper, bricks, beer and dairy products. It is the commercial centre for a large part of Morrison and adjoining counties. It has a fine courthouse, Saint Gabriel's Hospital, Saint Otto's Orphan Asylum, a city library and several good school buildings. Pop. 6,078.

LITTLE FALLS, N. Y., city, in Herkimer County, on the Mohawk River, the New York State Barge Canal and on the West Shore and the New York Central and Hudson River railroads, midway between Albany and Syracuse. The country around is rolling and diversified by many low hills, but Little Falls occupies that spot in the Mohawk Valley where in ages past the foothills of the Adirondack Mountains, the «Alps of America,» were joined to the headlands of the Catskill range by a barrier that set the waters back over a considerable portion of the fertile lands now under cultivation. When the barrier broke away by the action of the waters, the western gatewav of New York State was opened, with its peculiar rock formations. Through that narrow gateway occupied by Little Falls runs the Mohawk River, the new barge canal, the tracks of west- and east-bound steam and electric railroads and the main highway for automobile and carriage travel. So narrow is the gateway that in early colonial days the Indian warriors sped their messages on arrows from one hilltop to the other. The city occupies the site of an Indian village, visited in the 17th century by Jesuit missionaries. A white settlement was made here about 1770 or a few years later. In 1782 this settlement was destroyed by Indians and Tories. General Herkimer, a Revolutionary officer after whom the county is named, is buried in a cemetery near the city. No successful efforts were made to rebuild until 1790, when a colony of Germans took possession. The place was incorporated as a village in 1811; as a town in 1827; as a city in 1895. The city gets its name from the falls, or a series of cascades in the river, which descends 45 feet in less than a mile. «Picturesque and productive,» the grazing region around famous for its dairy and market products, Little Falls is especially noted for its diversified and prosperous manufacturing industries. These include knit-goods, hammers, felt shoes, knitting machines, paper, bicycles, incubators, cow-milking machines, sectional bookcases, leather, chemical laboratories, cream, butter, cheese and junket products, etc. Well-established banks, a prosperous building, savings and loan company and a progressive merchants' and manufacturers' association look after its commercial and financial interests. The city's assessed valuation is $6,963,870. The city has fine school and church buildings, Y. M. C. A. and Y. W. C. A. buildings and public library, new city hall, handsome government building, nurses' training school, city hospital, new Masonic Temple, Odd Fellows' Hall, theatres, good hotels and a well-equipped country club. Eleven public parks and squares, covering 44 acres, include Moreland park, one of the most picturesque hillside parks in central New York. A gravity system of waterworks furnishes in abundance pure mountain spring water; there are 20 miles of water mains; a modern salaried fire department; a modern electric light and power station; 25 miles of streets; and 8 miles of pavement. Pop. 13,100.

LITTLE GIANT, The, a familiar name applied to Stephen A. Douglas (q.v.) by his political admirers in allusion to his small stature and great intellectual capacity.

LITTLE JOHN, one of the outlaw comrades of Robin Hood. He was famed for his strength and was the only one of the company who could approach Robin Hood in skilful handling of the bow. By some authorities his name is supposed to have been John Nailor.

LITTLE KANAWHA, kă-nâ'wa, a river which rises in the central part of West Virginia, flows west and northwest and enters the Ohio River at Parkersburg. It is about 100 miles long, has considerable rapidity in the mountain section and is of benefit as a route for the transportation of the oil and lumber of that portion of the States through which it flows. It has been made navigable as far as Burning Springs, about 40 miles from Parkersburg.

LITTLE KEI, one of the important members of the group of East Indian islands known as the Kei Islands (q.v.).

LITTLE LORD FAUNTLEROY, a popular story for children by Mrs. Frances Hodgson Burnett, originally published in 1885 as a serial in the magazine *Saint Nicholas.*

LITTLE MAC, a nickname applied by the soldiers of the Union army during the Civil War to Gen. George B. McClellan (q.v.).

LITTLE MINISTER, The, by Sir James Matthew Barrie, «a love story, thrown into relief by a backing of Scotch puritanism,» as it was epitomized by an English reviewer, has for its scene of action the same as that of so many of Barrie's other tales and sketches, the Scotch village of «Thrums,» under which alias the author presents his own birthplace, Kirriemuir, a town largely populated by linen-weavers, about 62 miles north of Edinburgh. The novel was first published in 1891. The hero, Gavin Dishart, the young minister of that rock of rigidly orthodox Presbyterianism, the «Auld Licht Kirk,» serious, conscientious and indomitably brave, falls deeply in love with the fascinating and mysterious gypsy, Babbie, who, we are told by a Scottish critic, is delightful, yet «belongs not to Scotland, but to the realm of Oberon and Titania.» The young minister has no doubt that his first duty is toward the woman he loves, though a tempest of wrath is brewing in his devoted, but fiercely bigoted congregation; and in bringing the romance of his antithetical pair of lovers to a happy yet plausible ending through the heroism of the Little Minister, the author exhibits not only his ingenuity as a disentangler of plots but also, incidentally, his acknowledged mastery in depicting the pathos and humor of Scotch village life. Barrie's own dramatic version of the story has been repeatedly produced in both the United States and Great Britain with a success rivaling even the exceptional success of the book.

ARTHUR GUITERMAN.

LITTLE NELL, a child character in the novel 'Old Curiosity Shop,' by Charles Dickens. She was reared amid vice and crime, yet preserved a beautiful purity of character.

LITTLE OLD WORLD, The ('Piccolo mondo antico,' 1896), the undoubted masterpiece of the Italian writer, Antonio Fogazzaro, and one of the greatest novels of modern Italy, is the first of a trilogy, the other two volumes of which are 'Piccolo mondo moderno' (1901) and 'Il Santo' (1905). Known in English as 'The Patriot' ('Little Old World'), 'The Sinner' and 'The Saint,' these novels project against the background of Italian life in the second half of the 19th century the spiritual problems of the protagonists and their offspring. In the entrancing setting of Lake Lugano amidst whose beautiful hills Fogazzaro spent the impressionable years of his youth, 'Piccolo mondo antico' is a study of somnolent Valsolda during the eight years that preceded the expulsion of the Austrians in 1859. With a fidelity born only of accurate observation, Lombards and Venetians of every type appear in this magnificent evocation of those years of silent preparation. They speak their various northern dialects and are set off by that rich humor so typical of Fogazzaro's minor characters. The stony-hearted marchesa and her train of satellites, the lovable uncle Piero, the provincial gentry, the minions of Austrian despotism, patriots and spies, all stand forth with individual distinction. It is in this *milieu* that the main theme develops out of the conflicting ideals of husband and wife. Essentially a love match which has resulted in the young man's disinheritance, this union, through the inactivity and lack of energy of the dilettantic Franco Maironi, a devout religious idealist and a dreamer, is fast approaching disaster. The wife, Luisa, is a woman of strong will and moral force, filled with a sense of rectitude and justice, but lacking in religious faith. In the crisis brought about by the accidental drowning of their child, it is the husband who proves the stronger of the two. Taking consolation in his religion, he arouses himself, leaves for Piedmont to join his regiment and die for his country. The clash between the divergent ideals of Franco and Luisa, the separation and final reconciliation are worked out with characteristic poignancy. The novel typifies the intellectual and emotional conflict so favored by Fogazzaro. As is usual with him, it is the man whose spiritual nature is the higher, and in the triumph of Franco's intensely emotional and fervent Catholicism over Luisa's colder rationalism, we see exemplified the author's fundamental aspiration: "To live, love, labor, suffer and ascend."

Consult Lapham, L. E., 'Fogazzaro and his triology' (in *The Catholic World,* Nov. 1906–Jan. 1907); Faguet, Emile, 'Fogazzaro' (in *Revue des Deux Mondes,* 15 May 1911); Albertazzi, Adolfo, 'Il Romanzo' (Milan 1902); Croce, Benedetto, 'La letteratura della nuova Italia' (Bari 1914–15). The English translation, 'The Patriot,' is by M. Pritchard-Agnetti (New York 1906).

ALFRED G. PANARONI.

LITTLE ROCK, Ark., capital of the State, the seat of Pulaski County and the largest city in the State, on the Missouri Pacific, the Rock Island and the Saint Louis Southwestern railway systems, 133 miles west of Memphis, 346 miles southwest of Saint Louis, 165 miles east of Fort Smith and 145 miles northeast of Texarkana. Little Rock and North Little Rock is situated on both banks of the Arkansas River and takes its name from the rocky promontory which rises on the south bank some 50 feet above the river, now used as one of the abutments of one of the four bridges which span the river. This rock is the first seen ascending the river and was called Little Rock in contradistinction to the bold precipice, about 10 times higher, which rises some three miles above upon the opposite bank and called the Big Rock. This commanding eminence is now the site of an army post. The eastern border of the city touches rich alluvial cotton lands, without rocks and subject to a high state of cultivation; its western border reaches to the foothills of the Ozark Mountains. It is situated near lat. 35° and long. 92°, almost at the center of the State. The Arkansas River is navigable up to this point during the major portion of the year for the large steamboats, while smaller vessels ply as far up as Fort Smith. Pop. (est. 1919) about 90,000.

Trade and Commerce.— The growth of the commerce of Little Rock has been gradual but steady. The total annual business is estimated at $300,000,000, of which the retail business exceeds $100,000,000; a large portion of the other consists of cotton and its by-products. For example, in an average year Little Rock handles approximately 250,000 bales of cotton, representing financial transactions of over $35,000,000. The total freight traffic for the year 1918 employed 105,332 cars. The real estate transactions during the same year aggregated 3,555 sales, amounting to $5,237,194. The postal receipts for the fiscal year total about $890,763. The local Board of Commerce, a consolidation of all commercial organizations, is the organ for concert of action among business men. Little Rock is also the supply headquarters of the United States Bureau of Military Aeronautics for Arkansas, Oklahoma and northern Texas, and a million dollar warehouse plant is located at this point. During the late war the government constructed a munition plant at a cost of $7,000,000, which it is proposed to convert into a chemical or fertilizer plant, while Eberts Field, located 20 miles east, is a flying field, costing nearly $2,000,000. Camp Pike, an army cantonment built during the war, through which between 200,000 and 300,000 men passed, located eight miles north of Little Rock, has been designated by the government as a permanent army division post and has a capacity for 70,000 soldiers. This camp was named in honor of Gen. Zebulin Montgomery Pike, the explorer of the great West and Southwest, who discovered Pikes Peak. The citizens of Little Rock, through its Board of Commerce, donated in fee simple for $1 to the government the site for Camp Pike, 3,000 acres, and the munition plant, 400 acres, at a total cost of over $400,000.

Manufactures.— The largest single industry is the manufacture of cottonseed oil. There are six mills which have shipped, during a single season, 877 cars, or about 4,000,000 gallons of oil, 2,200 cars of meal and 584 cars of hulls. The latest available figures show 273 factories, employing about 15,000 persons, with an approximate annual pay-roll of $20,000,000. The manufacture of lumber and lumber products, such as staves, sash and doors, etc., principally hard woods, takes prominence, followed by furniture, tractors, automobiles, fertilizers; the largest brick factory and stone quarries and crushers in the State are located here; 80 per cent of the Bauxite ore of the United States from which aluminum is made is mined within a radius of 20 miles. Ice factories, printing and lithographing, overalls and garments, tents and awnings, harness, candies, packing-house products, foundries and railroad shops and four cotton compresses operate here.

Banks.— There are two national banks with a capital stock of $500,000 and surplus of $325,694.73, and annual deposits amounting to

$4,727,159.93; also 12 trust companies with a capital stock of $2,983,000, surplus and profits $1,201,315.89, with deposits of $25,780,355.39 and loans of $23,300,000. The local bank clearings for 1918 aggregated $272,875,892. Besides these, there are building and loan associations with aggregate stock of about $10,000,000.

Government and Finances.— All municipal corporations in Arkansas are governed by general laws and not by special charter. The mayor, treasurer, police judge, city clerk and city attorney as well as the aldermen are elected biennially. The city council is composed of the mayor and 18 aldermen, two of whom are elected from each of the nine wards by the voters of the entire city and are required to reside in their several wards. The administrative officers are partly appointed by the mayor and partly elected by the council.

Churches and Charitable Institutions.— Little Rock is a city of numerous churches and chapels. It is the seat of Roman Catholic and Protestant Episcopal cathedrals, Saint Andrew's and Trinity. The former, at the corner of Seventh and Louisiana streets, is a noble edifice, built of native granite, the most striking piece of architecture in the city. Other notable buildings are Christ Church (Protestant Episcopal), the Eighth Street Methodist, the German Evangelical Lutheran, the First Presbyteral Church and the Jewish Temple. There are 7 Baptist churches, 4 Catholic churches, 3 Christian churches, 1 Congregational, 1 Christian Science, 6 Episcopal, 2 Hebrew, 3 Holiness, 2 Lutheran, 12 Methodist, 6 Presbyterian and 4 miscellaneous. Of the charitable institutions the more notable are the county and city hospitals, Saint Vincent's Infirmary, conducted by the Sisters of Mercy, the Children's Home, the Methodist Orphanage, the Jane Kellogg Home for Aged Women, the Home for Aged Colored Women, and the Boys' Club; the Y. M. C. A. and Y. W. C. A. both operate well-equipped and commodious homes.

Buildings, Parks and Suburbs.—Little Rock is noted for the beauty of its homes. The profusion of its flowers have won for the city the name of "the City of Roses." All of the State's public institutions, except the University of Arkansas at Fayetteville and the Branch Normal Institute for colored youths at Pine Bluff, are located here. These include the State House, the School for the Blind, Deaf-Mute Institute, State Hospital and the State Penitentiary. The State has erected a new capitol, built of Arkansas marble. Other public buildings of note are the Pulaski County Courthouse, constructed of granite quarried in the vicinity, the customhouse and post office, and the Board of Trade building. Of club houses are the Country Club, the Athletic Association, Quapaw, and the Elk's Lodge; social organizations, Concordia Association, a Jewish Club, Jewish Country Club, the Masonic Temple, the Albert Pike Consistory, and the new Shriner's Temple. The City park, consisting of 35 acres of ground, is situated in the heart of the residence portion of the city and is tastefully laid out in walks and drives and well kept up. The Arkansas River is crossed by three railroad bridges and a free bridge erected by Pulaski County at an expense of nearly $400,000, uniting the northern and southern portions of the city. A new concrete free bridge costing over $1,000,000 is contemplated. There are two incorporated suburbs of the city, Baring Cross, a thriving town of 800 inhabitants lying north of the Arkansas River and west of the city limits, and North Little Rock, a small town lying north of the river and of the city; Pulaski Heights, a picturesque hill overlooking the city and river, has become fashionable for residences. Mount Holly, the oldest cemetery in the city, is beautifully adorned with shrubs and flowers, and has many fine monuments. Other cemeteries are Oakland, the Jewish, the Catholic, the National, the Confederate and the Colored. The city is aboundantly supplied with pure water obtained from the Arkansas River and deep wells. There are two reservoirs with a storage capacity of 17,000,000 gallons, with an average daily consumption of 6,000,000 gallons. There are 65 miles of water mains.

The streets are laid out with regularity. The principal retail thoroughfare is Main street, the jobbing street is Markham, the former running north and south and at right angles to the latter. There are within the city 249.02 miles of opened streets, 78.49 paved with brick, granite, asphalt, Telford or macadam pavement, 190 miles of sewers and 180 miles of sidewalks. The street railway lines cover 29 miles.

Education.— The single school district of Little Rock is a corporation distinct from the city, its territory including only that portion of the city which is south of the river. Here there are 20 schools, with 24 buildings, of which five schools with five buildings are for the colored children, 325 teachers and an enrollment of 11,425, of whom 1,607 are colored. The school census shows a total of 15,000, of which about 3,500 are colored. The North Little Rock school district, including so much of the city as lies north of the river, has in all six school buildings, two of which are for colored children, 15 teachers and an attendance of 885. The school census shows that 2,600 are entitled to attend the public school in that district. Besides the public schools there are private and parochial schools. For higher education the Little Rock College for boys and Saint Mary's Academy for girls, both Catholic institutions, are the largest; the University of Arkansas, the main departments of building of which are located at Fayetteville, has branch schools of law and medicine located here. Besides these are the Arkansas Military Academy, a military training school, and the Philander Smith College for colored youths.

History.— When the territory now known as Arkansas passed to the United States in 1803, the site of the future capital was an unbroken wilderness. By the act of Congress of 2 March 1819, the seat of government of the newly created territory was fixed at the Post of Arkansas on the Arkansas River some 30 miles above its confluence with the Mississippi. On 24 Oct. 1820, an act was passed removing the capital to Little Rock. It has been aptly said that so manifest was the destiny of the future city that it was made the seat of government before it had become a town. A post office was established on 10 April 1820. It was incorporated as a town 27 Oct. 1825. It is said that the inhabitants numbered only 450 in 1830. On 2 Nov. 1835 it was, by special act, incorporated as a city. When the momentous question of secession arose in 1861, a convention was called by the legislature to meet at Little Rock, which adopted an ordinance dissolving the union existing between the State of Arkansas and those united with her under the compact entitled, "The Constitution of the United States of America." On 10 Sept. 1863, Little Rock was captured by the Northern army under General Steele and remained in possession of the Federal forces during the remainder of the war. The unexpected increase in the population between the years 1860 and 1870, covering the period of the Civil War, may perhaps be attributed to the fact that during that period of disintegration society was forming new associations. The growth of the city since 1880 has been constant and rapid. Pop. (1850) 2,167; (1870) 12,380; (1890) 25,874; (1900) 38,307; (1910) 45,941.

George Firmin,
General Manager, Little Rock Board of Commerce.

LITTLE ROCK, Capture of. The State authorities of Arkansas seized the United States arsenal at Little Rock 8 Feb. 1861, and until 10 Sept. 1863 the city remained in Confederate occupation. After the fall of Vicksburg and Port Hudson, 4 and 8 July 1863, Gen. F. Steele was ordered from Vicksburg to Helena and directed to form a junction with General Davidson, who was moving south from Pilot Knob, Mo., to break up Sterling Price's army, and occupy Little Rock. Steele arrived at Helena 31 July and organized his expedition, finding at that place two divisions of infantry, a brigade of cavalry and 39 guns; in all, about 7,000 men. On 5 August he marched for Devall's Bluff on White River, reached it without incident and there was joined by Davidson with 6,000 cavalry and three batteries, making his force about 13,000 men and 57 guns. A few days later he was joined by a brigade which raised his aggregate to over 14,000, of whom 10,500 were effective, many being sick. August 24 Davidson's cavalry advance skirmished with Marmaduke's cavalry up to and through Brownsville and up to his entrenchments at Bayou Meto. Davidson fell back to Brownsville, where, 2 September, Steele joined him, and concentrated all his available force. The position on the Bayou Meto, 12 miles from Little Rock, was flanked, and on the 7th Steele reached the Arkansas River near Ashley's Mills, where Davidson's cavalry had a sharp skirmish and drove the Confederates across the river. Steele repaired the main road back to Bayou Meto, and on the 10th Davidson crossed to the south side of the river by a pontoon bridge and marched on Little Rock, but 10 miles distant, Steele marching along the north bank. The city was defended by Sterling Price with about 7,700 men, of whom 6,500 were entrenched on the north side of the Arkansas, and about 1,200 on the south side, on the line of the Bayou Fourche, about five miles from the city. Davidson moved directly on the city, without much opposition until he reached Bayou Fourche, where he found Marmaduke's cavalry, dismounted, a brigade of infantry and two batteries, all drawn up to oppose him. Davidson attacked on two roads, driving the Confederates back; Steele, who had marched abreast of him on the opposite side of the river, opened an enfilading artillery fire; and Marmaduke fell back through the city, closely followed by Davidson's cavalry. Price had withdrawn from the north bank of the river when he learned that Davidson had turned the position, and evacuated the city at 5 P.M., retreating to Arkadelphia. Steele's cavalry followed Marmaduke's cavalry for a day, and returned to Little Rock on the 12th. At 7 P.M. the city was formally surrendered to Davidson by the civil authorities. Price burned eight steamers, one of them a powerful gunboat, but the arsenal was saved. Steele reported a loss of 137 killed, wounded and missing; Price reported a total loss of 64. Consult 'Official Records' (Vol. XXII); Lossing, 'History of the Civil War' (Vol. II); The Century Company's 'Battles and Leaders of the Civil War' (Vol. III).

E. A. Carman.

LITTLE RUSSIANS. See Ruthenes.

LITTLE TURTLE, Miami chief: one of those who signed the Treaty of Greenville in 1795. He defeated Harmar on the Miami in 1790 and St. Clair at Saint Mary's in 1791.

LITTLE WOMEN, a popular story for children by Louisa M. Alcott (q.v.), published in 1868.

LITTLEHALES, George Washington, American hydrographic engineer: b. Schuylkill County, Pa., 14 Oct. 1860. He was graduated from the United States Naval Academy in 1883. He is an associate editor of the *International Journal of Terrestrial Magnetism*, and has published 'The Development of Great Circle Sailing'; 'The Methods and Results of the Survey of Lower California'; 'The Magnetic Dip or Inclination'; 'The Azimuths of Celestial Bodies,' and other works, all issued by the United States Navy Department. He has made many important researches in hydrography, oceanography and terrestrial magnetism and has published about 3,000 charts.

LITTLEJOHN, Abram Newkirk, American Protestant Episcopal bishop: b. Florida, Montgomery County, N. Y., 13 Dec. 1824; d. Williamstown, Mass., 3 Aug. 1901. He was graduated at Union College in 1845 and took orders in the Episcopal Church in 1850. He was rector of Saint Paul's, New Haven, Conn., 1851–60, and of Holy Trinity Church, Brooklyn, N. Y., 1860–69. He was made bishop of Long Island in 1869, and from 1874 was in charge of American Episcopal churches on the continent of Europe. He wrote 'Philosophy of Religion'; 'The Christian Ministry,' etc.

LITTLETON, or LYTTLETON, Sir Thomas, English jurist: b. Frankley, Worcestershire, 1422; d. there, 23 Aug. 1481. He was a member of the Inner Temple, sheriff of Worcestershire in 1447, recorder of Coventry in 1450, and in 1453 was made sergeant-at-law and justice of assize in 1455. After holding several legal appointments he became justice of the common pleas in 1466. His treatise on 'Tenures,' with the well-known commentary by Sir Edward Coke, 'Coke upon Littleton,' was long the standard authority on the English law of real property. It was written in legal French, and first published in London about 1481. 'Coke upon Littleton' was first published in English in 1628, and there are many subsequent editions.

LITTLETON, N. H., town, in Grafton County, on the Ammonoosuc River, and on the Boston and Maine Railroad. When it was first settled in 1770 it was called Apthorp. When it was incorporated, in 1784, the name was changed to Littleton. It is in a section of the State noted for its beautiful scenery and cool summer climate. The river furnishes considerable water power; the chief manufactures are shoes, gloves, wagons and carriages, whetstones, bobbins, stereoscopic views, woodenware and furniture. Electric lighting is municipally owned, and the town has a Carnegie library and a hospital. The government of the town is administered by means of the annual town meeting. Pop. about 4,069. Consult 'History of Littleton' (3 vols., Cambridge, Mass., 1905).

LITTMANN, lĭt'man, **Enno,** German Oriental scholar: b. Oldenburgh, 1875. He traveled extensively in the near East, including Abyssinia, Palestine and Syria; came to America where he spent several years as lecturer on Semitic philology at Princeton University. He was appointed to the chair of Semitic languages at the University of Strassburg in 1906. In 1910–12 he was professor at the University of Egypt, after which he returned to his old chair at Strassburg. He visited Abyssinia and Syria with the Princeton archæological expedition and accompanied the Axum expedition of 1906. He has published 'Arabische Schattenspiele' (1901); 'Zur Entzifferung der Safâ-Inschriften' (1901); 'Chronicle of King Theodore of Abyssinia' (1902); 'List of Arabic Manuscripts' (1904); 'Zur Entzifferung der thamudenischen Inschriften' (1904); 'Philosophi Abessini' (1904); 'Geschichte der äthiopischen Literatur' (1907); 'Arabische Beduinenerzählungen' (1908); 'Nabatæan Inscriptions' (1913).

LITTORAL, that belt along a coast, between low and high tide limits. The term is sometimes extended to include the very shallow water just beyond low tide limit. Currents parallel to the shore are known as littoral currents, and the deposits of the littoral belt are called littoral deposits. See SANDSTONE.

LITTRÉ, Maximilien Paul Emile, mäk-sĭ-mĭl-ĭ-ŏṅ pōl ā-mēl lĕ-trā, French lexicographer and philosopher: b. Paris, 1 Feb. 1801; d. there, 2 June 1881. After completing his course at school he studied deeply in English and German and in classical and Sanskrit literature. He intended to follow the medical profession; his study of medicine was interrupted by the death of his father. He then engaged in teaching for a livelihood, took an active part in the Revolution of 1830, and soon after was invited by Armand Carrel, editor of the *National,* to write for that paper. In 1839 he published the first volume of an edition of Hippocrates in the original, with a French translation and copious notes. This work, in 10 volumes, secured his admission to the Académie des Inscriptions et Belles-Lettres. He translated Strauss' 'Leben Jesu,' and having adopted Comtist principles, wrote an able and lucid synopsis of them in his 'De la Philosophie Positive' (1845). In 1854 he was appointed editor of the *Journal des Savants.* In 1863 he commenced the publication of his great work, begun nearly 20 years earlier, the 'Dictionnaire de la Langue française,' which has been called the best dictionary of any living language yet published, and is a monument of its author's patience and lucidity no less than of his erudition. This was finished in 1873, two years previous to which Littré had been admitted into the Académie Française. Another important work of his was an edition of Pliny's 'Natural History' with a translation and notes. During the siege of Paris he was forced to retire with his family to Bordeaux, and was appointed professor of history and geography in the polytechnic school there. He was afterward summoned to Versailles to take his seat in the Senate, having been chosen by the department of the Seine. He became a life senator in 1875. Among Littré's other works are 'Application de la Philosophie Positive au Gouvernement des Sociétés' (1849); 'Conservation, Révolution et Positivisme' (1852); 'Paroles de la Philosophie Positive' (1859); 'Histoire de la Langue française' (1862); 'Auguste Comte et la Philosophie Positive' (1863); 'Études sur les Barbares et le Moyen Age' (1867); 'Médecine et Médecins' (1871); 'Literature et Histoire' (1875), and 'Études et Glanures' (1880).

LITTROW, lit'rō, **Joseph Johann von,** Austrian astronomer: b. Bischofteinitz, Bohemia, 13 March 1781; d. Vienna, 30 Nov. 1840. In 1807 he obtained the chair of astronomy in the University of Cracow, and in 1810 accepted a similar chair in Kasan, where he founded the observatory. He became in 1816 joint director of the observatory of Buda, and from this he removed in 1819 to become director of the observatory of Vienna. He completely reorganized this establishment, and in his lectures yearly attracted great audiences, many of them strangers from abroad. By far the most popular of all numerous astronomical works is his 'Die Wunder des Himmels,' of which the 8th edition was published (1895–97). It ranks as one of the best works of astronomy for the use of general readers.

LITTROW, Karl von, Austrian astronomer: b. Kasan, Russia, 18 July 1811; d. Venice, 16 Nov. 1877. He was a son of Johann Littrow (q.v.), whom he assisted in the Vienna Observatory from 1831 and succeeding him as director in 1842. He edited the works of his father, adding considerably to 'Die Wunder des Himmels,' developed a new method of reckoning longitude at sea, and was the author of 'Populäre Geometrie' (1839); 'Verzeichniss der geographischen Ortsbestimmungen' (1844–46).

LITURGY (Greek λειτουργία means a public service; used at Athens to mean a public service which the richer citizens discharged at their own expense). The Septuagint translators used the Greek word *leitourgos* for that service of God in the sanctuary. In the Hebrew it had various kindred meanings; in the Old Testament is usually denotes the service of a Jewish priest, but in the New Testament it is used of any service rendered to God. In the 4th century, the word as applied to priestly ministrations was generally recognized; and while it continued in use as meaning any solemn service, it was applied especially to the Eucharistic service. It is in this sense that the word is used by the Greek Church when they say «Divine liturgy.»

The records extant which show the exact liturgy of the Christian Church in the 1st century are mainly allusions found in documents of the 2d century. From the year 150 there are numerous proofs to show the existence of a fixed order and fixed words for the service of the mass or for the Eucharistic service. This service or liturgy was not made just when mentioned by Cyprian, and in 138 by Justin, and many others who committed to writing the order of the services or the liturgy. But there is not sufficient proof to warrant the assertion that there was any entire written liturgy before the second half of the 4th century. As the liturgies exist to-day they may be divide into five groups or families of liturgies, distinguished from each other chiefly, though not entirely, by the different arrangement of their parts. Three of the groups are Oriental and two are Western. They are:

(1) The West Syrian Group, which includes the liturgies of Saint James, Saint Basil, Saint Chrysostom and that of Armenia. In this group the intercession for the living and the dead is placed after the invocation of the Holy Spirit, which in the Oriental liturgies follows the consecration.

(2) The Alexandrian Group, which includes three Greek liturgies: Saint Mark, Saint Basil, and Saint Gregory; also the Coptic liturgies. This group is characterized by the «Great Intercession» for the living and the dead being placed in the midst of the Preface.

(3) The East Syrian Group includes the liturgies in the Syriac language as used by those who belong to the Roman Catholic Church. In this group the «general intercession» is placed between the words of institution and the invocation of the Holy Spirit.

(4) The Liturgies of Gaul and Spain. In this group the «Great Intercession» comes just after the offertory, though the Mozarabic liturgy has a memento of the living before the Pater Noster.

(5) Gallican Liturgy. In this the intercession is divided, that of the living is before consecreation, and that of the dead after consecration.

That part of the «Liturgy of the Mass» called the «canon» is very ancient, and existed almost as at present since the time of the Apostles (see MASS; MISSAL). The liturgy of the Church of England is derived from the Ephesine original through the ancient Gallican liturgy which was brought to France by Greek missionaries, who were accustomed to use the form known as the liturgy of Saint John. There is no invocation of the Holy Spirit in the present English form, although the Protestant Episcopal Church has restored the invocation, like the Scottish Episcopal Church. There is, however, no ritual element wanting in these two English forms whether they be compared with the Greek or Latin liturgies. The liturgy in use in the Protestant Episcopal Church more nearly resembles the Gallican liturgy than any other group, but in some respects there is a difference in arrangement, and also in meaning. There is no intercession for the dead, and the intercession for the living comes before the Communion.

Bibliography.—An exhaustive bibliography appears in the catalogue of the British Museum. Consult also Tertullian, 'De Corona'; Cyprian, 'Epistle'; Report of Council in Trullo' Probst, 'Liturgie der drei ersten Jahrhunderte,' who claims that there was a written liturgy before 150; Hammond, 'Ancient Liturgies'; Smith and Cheetum, 'Liturgies'; Rock, 'The Church of Our Fathers, as Seen in Saint Osmond's Rite for the Cathedral of Salisbury' (1904); De Herdt, 'Sacra Liturgie' (3 vols.); Fortescue, 'The Mass: A Study' (1912); Staley, 'Liturgical Studies' (1907); York, 'The Roman Liturgy' (1908), and 'The Prayer Book Dictionary,' edited by Hartford and Stevenson (1912).

LITUUS, lit'ū-ŭs, (1) a crooked staff, represented in works of art as borne by the ancient Roman augurs in their divinations. It was like a crozier in shape. (2) A trumpet, having a mouth which curved upward, and which was used by the Roman cavalry. (3) In geometry, a spiral, of which the characteristic property is that the square of any two radii vectores are reciprocally proportional to the angles which they respectively make with a certain line given in positioin and which is an asymptote of the spiral.

LIUDGER, lī-ood'ger, **Saint,** the first bishop of Münster, Germany: b. Friesland, about 744; d. Billerbeck, 26 March 809. He studied in England under Alcuin and returned to preach Christianity to his countrymen. When Wittekind was sent to Friesland in 784 Liudger abandoned his mission and went to Rome. Subsequently he returned to become the first bishop of Münster. The various *Vitæ S. Liudigeri* are collected in the 'Geschichtsquellen des Bistums Münster' (Diekamp 1881). Consult also the Lives by Hüsing (1878); Pingsmann (1879), and Krimphove (1886).

LIUDPRAND, lī-ood'prănd, **LIUTPRAND,** or **LIUZO,** Italian historian: b. about 922; d. 972. He was of a noble Lombard lineage. His father, who was King Hugo's Ambassador to Constantinople, dying when the son was not more than five years old, young Liudprand was educated as a page in King Hugo's court in Pavia, and later entered the Church. Hugo's successor, Berengar, made him chancellor, and in 949 sent him on an important diplomatic mission to Constantinople. Soon afterward he fell into disgrace with Berengar, oined himself to the Emperor Otho I, who, in 962, made him bishop of Cremona, and in 968 sent him on an important but unsuccessful mission to the court of the Eastern Church, which called forth his bitter but interesting and lively 'De Legatione Constantinoplelitana.' His 'Antapodosis' covering the period from 886-950, and 'De Rebus Gestis Ottonis Magni imperatoris,' from 960 to 964, are important sources of 10th century history. They are all found in the Pertz' 'Monumenta Germaniæ Historia.'

LIU-KIU (lē-oo'kē-oo') or **LOO-CHOO ISLANDS,** Japan, a chain of 55 islands, three large and 52 small, with a total area of 808 square miles. They form a integral part of the empire, and, extending in a southwesterly direction from a series of stepping stones between Kiu-shu and Formosa. Oshima in the northwest, 30 miles long, contains a mountain peak 2,300 feet high, and has a mean annual temperature of 70°. Tokuno-shima is in the centre of the group. Okinawa or Greater Loo-choo in the southwest is 60 miles long by two to 14 broad. Naha, the capital of the group (pop. 48,000), is a modern Japanese town. The islands constitute the Japanese prefecture of Okniawa and have a population of 502,000. Sugar, wheat, potatoes, bananas and sago are the principal crops. An active trade is maintained with Japan by means of a steamship service. The inhabitants are honest, courteous, industrious and peaceable. Their language differs from the Japanese in being more archaic. Liu-Kiu Islands were originally part of the kingdom of Liu-Kiu, and were conquered for Japan by the Prince of Satsuma in 1609. See Japan.

LIU-KUN-YI, lē-oo-koon'yī, Chinese statesman: b. Hunan, about 1820; d. Nanking, 6 Oct. 1902. He received a military education, and though not a scholar held high official positions. In 1860 he commanded one of the armies raised to oppose the Taiping rebels, and defeated them by a series of successful manœuvers. At the time of the Boxer outbreak in 1900 he was viceroy of Nanking, the so-called «southern capital» of China, and in spite of the vigorous anti-foreign agitation in his own province and the hostile attitude of the imperial government at Peking, he refused to join the anti-foreign movement, and used his foreign-drilled troops to suppress all Boxer demonstrations. In this he was supported by the viceroy of Wuchang, and these two viceroys prevented the spread of the Boxer movement to the valley of the Yang-tse-Kiang, and were consequently influential in safeguarding Chinese interests in the subsequent peace negotiations. He took a leading part in negotiating with Sir James Mackay the commercial treaty of 1902.

LIUTPRAND, lē-oot'prănt, Italian historian. See Liudprand.

LIUTPRANT, or LIUTPRAND, king of the Lombards (q.v.) from 712 to 744, the period of their greatest power: b. about 688; d. 744. He was an active and popular prince. He captured Ravenna in 728, defeated the dukes of Spoleto and Beneventum in 741, joined with Charles Martel against the Arabs and extended the Lombard sway over practically the whole of Italy. His death marked the beginning of the downfall of the kingdom. His laws are codified in the ‹Edicta Liutprandi.›

LIVADIA, lĭv-ā-dē'ā, or **LEBADEA,** Greece, a town on the Hercyna, 52 miles northwest of the capital of the monarchy of Bœotia. Under Turkish rule it was the most important town in Greece. It is defended by a castle, and has manufactures of cotton goods and a trade in small articles or raw produce. Pop. 6,500. Higher up the river, in a narrow gorge, is the site of the ancient Hieron or cave of Trophonius and the fountains of Lethe and Mnemosyne.

LIVADIA, a Russian imperial residence near Yalta, on the southern coast of the Crimea, Russia. It is an extensive and beautiful estate, with two fine palaces, the new or large palace completed in 1911, and many less important villas and lodges. It was the favorite residence of Alexander III, who died there 1 Nov. 1894. When the Emperor Nicholas II was forced to abdicate the throne, 15 March 1917, he expressed the desire to go to Livadia, to his gardens.

LIVE-FOR-EVER, or GARDEN ORPINE, a small cultivated stonecrop, *Sedum tlephium*. See Stonecrop.

LIVE OAK, species of evergreen oaks found growing in various parts of the United States, Central America and Cuba. See Oak.

LIVE STOCK. See Cattle.

LIVE STOCK, The Feeding of. Balanced Ration.—A ration is the amount of food fed to an animal in one day of 24 hours. As with humans this ration is usually fed in three meals. A balanced ration is a ration which will fully meet all the physiological needs of the particular animal to which it is to be fed. Very briefly a properly balanced ration must meet the following principal needs:

1. There must be sufficient food to furnish the energy to enable the given animal to do its work.
2. The ration must have the proper amount of protein and the right kind of protein to meet the body needs for this important constituent.
3. The ration must supply the proper mineral elements.
4. The ration must supply the proper amounts of those not very well understood substances which are called growth accessories or vitamines.

Only those rations which meet these four primary needs can be said to be properly balanced. Therefore it is necessary to know something of the composition of the animal body and of feeds in order to understand why feeds should be grouped in certain proportions to constitute what is called a ration.

The body of any animal is made up of water and dry matter which must all come from the food.

The Water in the animal body serves four purposes: first, it is a part of all bone and flesh; second, it serves as a carrier of food from the digestive tract, or from those parts of the body where the food is put into suitable shape to be used by the body cells, to those cells wherever they may be located; third, water serves to carry away the wastes of the body through the perspiration and the urine; fourth, it serves to equalize the temperature. This water in the body comes from the water that the animal drinks and from the water in the succulent parts of the food. The water in the animal body constitutes on an average about 50 per cent of the live weight.

The Dry Matter of the Body is made up of many chemical elements — for example, carbon, hydrogen, oxygen, nitrogen, sulphur, phosphorus and perhaps half a dozen others. These elements are arranged in all sorts of combinations, to form bones, flesh, hide, hair, hoofs and other parts of the body. For the purpose of this discussion, in order to get a clear understanding of the relation of the food to the body the dry matter may be divided into four groups of substances, namely, ash, nitrogenous substances or protein, carbohydrates and fast. The dry matter of the body is so grouped because this is the usual grouping of the chemical compounds that make up plants, and it is desired to study the relation of the groups in plants with the same groups in the body.

Demands of the Animal from Its Food.—Animals need food to maintain their existence, which is dependent on matter and energy. The part of the body that is more or less permanent is that made up of ash and protein, while the carbohydrates and fats are more changeable and have to do more with the energy of the body. However the tissues are constantly being worn out, and must be replaced, and this requires a new supply of ash and protein from the food.

Besides the ash and the protein constantly being replaced in the mature animal, the growing animal must have matter to form new tissue, and the productive animal must have matter for products such as milk, eggs, wool and the like, all of which contain ash, fat, protein and carbohydrates. Then, in the pregnant female, ash, fat, protein and carbohydrates are needed for the growth of the young.

After this matter has been supplied from the food for the maintenance of the dry matter of the body, there is a still further demand on the food to furnish energy to the animal for various uses. First, the temperature of the animal body must be about 100° F., and, while the temperature of the surrounding air may vary all the way from — 20° to + 90° F., this body temperature must be kept practically constant, requiring considerable energy in the form of heat; second, energy is required to keep up all the changes in the body in preparing food for use by the body, to take that food where it is needed, and to carry out waste matter from the body; third, energy is needed to manufacture products such as milk, wool, eggs and the like; fourth, energy is needed to enable the animal to do work, as in the case of the horse.

In addition to the requirements for maintenance of tissues and for energy the body requires a supply of water daily, in order to keep up the water content of the body and to provide a medium for the transfer of the food material from different parts of the body to other parts and for the elimination of waste matter.

How the Food Fulfills These Requirements.— Like the body, the common coarse feeds, grains, meals and feedstuffs in general used for animals are made up of the following groups of constituents:

- Water
- Dry matter
  - Ash
  - Nutrients
    - Protein (nitrogenous)
    - Carbohydrates (fiber, nitrogen-free extract)
    - Fats

The use of the water in the food has already been indicated.

The Ash required by the animal does not need to be computed carefully because all the ordinary feeds furnish it in sufficient amount, provided a good variety is given and plenty of salt is supplied. Corn is slightly deficient in ash, but in the ordinary ration the feeds fed with corn make up for this deficiency.

Protein, carbohydrates and fats in food are commonly spoken of as the nutrients of the dry matter, since it is from those groups of constituents that animals derive the matter and energy necessary for the uses already enumerated. The protein is used to keep up the protein of the body — that is, to replace worn-out tissues, to build up new tissues, for growth of hair, hoofs, horns and the like. A very important fact in this connection is that any protein in the ration in excess of that required for keeping up the nitrogenous tissues of the body can be used by any animal for the production of heat and energy. On the other hand, while protein can be used thus for the production of heat and energy, thus serving the purpose of carbohydrates and fat, protein cannot be produced from the carbohydrates or the fats of feeds. Therefore it is always necessary to have a sufficient amount of protein in the ration. The discussion of the necessary amount of protein for different uses will be taken up later under various rations given.

The amount of digestible protein in feeds varies within somewhat wide limits. The percentage varies from 0.8 of 1 per cent in succulent feeds, such as mangels, through 7.6 per cent for red clover hay and 8.5 per cent among the cereals, to as high as 37 per cent for cottonseed meal. Thus it is seen that there is a large list from which to choose in regulating the amount of protein in a ration.

The Carbohydrates are divided by the chemists into what are called "crude fibre" and "nitrogen-free extract," because the crude fibre is less digestible than the other carbohydrate material. In a feed analysis, ash, protein, fat and fibre are first determined. Their sum is then subtracted from the total dry matter, and the result is called "nitrogen-free extract." This term includes all the carbohydrates except the fibre. The digestible nitrogen-free extract and the digestible fibre have the same food value for all practical purposes and perform the same work in the nutrition of the animal. This work consists mainly in furnishing energy for whatever need the animal may have. If there is more energy provided in the ration than is needed at that particular time, the excess energy may be stored in the body as fat.

The amount of fibre and nitrogen-free extract in feeds, taken together, varies as much as does the protein, but there is always a relatively larger amount of carbohydrates than of protein. In every case, when there is a low percentage of protein there is a high percentage of carbohydrates.

The Food Fats are used by the animal in about the same way as are the carbohydrates. They provide energy to be used in any way that the animal needs, and if the animal has more energy than is needed, it may be stored in the form of fat. The fat, however, has an energy value equal to about two and one-fourth times the energy value of the same weight of carbohydrates.

The amount of digestible fat in the different feeds varies without respect to the other constituents. It is low in the coarse fodders, running up to 11.6 per cent in distillers' dried grains.

Factors in an Ideal Ration.— In actually computing a ration for a given purpose there are six factors that should be considered:

1. Amount of food.
2. Digestibility of the ration.
3. Variety in the ration.
4. Suitability of the feeds to the animal.
5. Palatability of the ration.
6. Cost of the ration.

The Amount of Food in a ration has reference to the relative amounts of roughage and concentrates. By roughage is meant the coarser feeds, such as hay, corn fodder, silage; by concentrates are meant the grains and the other feeds in the ration that are low in their percentage of fibre and water and high in their percentage of total digestible nutrients.

Horses at work should be given two to three pounds of feed (roughages and concentrates combined) daily per 100 pounds live weight, the allowance of concentrates ranging from 10 to 18 pounds, depending on the severity of the work.

Dairy cows in milk should be fed about two pounds of dry roughage or one pound of dry roughage and three pounds of silage daily per 100 pounds live weight, with one pound concentrates to three or three and one-half pounds of milk yielded.

Fattening steers need two and one-tenth pounds or more of concentrates and dry roughage (or the equivalent in silage) daily per 100 pounds live weight, the allowance of concentrates ranging from less than one pound to one and seven-tenths pounds, or more, per 100 pounds live weight, depending on the rate of gain desired and the kind of roughage.

Fattening lambs will consume about one and one-fourth pounds of dry roughage daily when fed all the grain they will eat, and up to two and three-tenths pounds or over when the grain allowance is restricted. Silage may replace a corresponding amount of dry matter in dry roughage.

Pigs can make but limited use of dry roughage, except in the case of brood sows not suckling young.

The Digestibility of the ration also depends a great deal on the relative amounts of roughage and concentrates, and on the character of the concentrates. As a general rule the more intense the feeding the more concentrated the ration will be and consequently the more highly digestible it will be. Care must always be taken that the ration is not too concentrated.

Variety in the Ration.—All feeders of animals should provide variety in the ration. Variety stimulates the animal's appetite. Best results are obtained from rations for dairy cows that have two different feeds in the roughage and three feeds in the concentrated part of the ration. These feeds should come from not less than three different plants. Other classes of animals do not seem to need so much variety, although it is wise to supply it with all classes.

Suitability of Feeds to the Animal.—The feeds in the ration should be suited to the animal and to the purpose for which the animal is fed. For example, wheat bran is not suitable for feeding hogs because of its bulk; wheat middlings are much to be preferred.

Palatability of Feeds to the Animal.—The ration should be palatable if the best results in production are to be obtained. With dairy cows palatability is easily obtained by providing succulent feed in the ration. The condition of the feed has much to do with its palatability. No musty nor damaged feed should be given.

Cost of the Ration.—Without doubt, the cost of the ration is the most important factor to be considered by the farmer. However, the other factors must not be sacrificed for cost in every case. There is no general rule to be given in regard to cost. If one has access to a set of tables which give the pounds of total digestible nutrients, a rough way, efficient in most cases, to choose feeds for the greatest economy in the ration is to calculate the cost of 100 pounds of total digestible nutrients in the different feeds available, then to choose those that will yield total digestible nutrients the cheapest — always taking into consideration the five other factors that have just been explained. Too little attention has been paid to the proper compounding of rations to get the best returns in product from the money paid out for feed, whether that feed has been actually bought in the market or produced on the farm. The possible usefulness of many home-grown crops is not known to many farmers. If clover hay, alfalfa hay, roots and silage are raised, the bills for grain may be reduced very much. These crops can all be raised and fed at a profit, since at their usual market price they will yield digestible material cheaper than will any of the commercial feeds. A knowledge of the composition of these home-grown crops is necessary, in order to fit them into the ration intelligently. A farmer should study from all sides the possibilities of his farm, and produce all the feed for his stock that he can. Then he should buy those commercial feeds that will round out his rations properly. Many farmers never set any price on the feeds produced on the farm, considering them merely as feeds procured at no money cost and therefore to be fed without regard to quantity or composition.

Instead of feeding in a haphazard manner, a farmer should know, at least approximately, the cost of producing his homegrown feeds, how to plan his rations in order to use these feeds to the best advantage and how to buy intelligently the feeds on the market. This knowledge will enable him to calculate the most economical ration for the animal that he wishes to feed, whether dairy cow, sheep, horse or beef animal.

A Ration for a Dairy Cow Illustrating the Factors Given.—A ration is desired for a cow weighing 1,000 pounds and yielding daily 30 pounds of milk testing 3.5 per cent butterfat.

The following feeds are commonly used for cows except the skimmilk, tankage and dried blood. They are divided into three groups for convenience in the discussion of rations which follow.

CONCENTRATES.

Low protein.	Medium protein.	High protein.
Corn meal or chop.	Red dog flour.	Gluten feed, high grade.
Corn and cob meal.	Flour wheat middlings.	Malt sprouts.
Hominy feed.	Standard wheat middlings.	Brewers' grains, dried.
Wheat.	Wheat bran.	Buckwheat middlings.
Rye.	Wheat feed (shorts and bran).	Cottonseed meal, good.
Oats.		Linseed meal, old process.
Barley.		Pea, field.
Kafir.		Skim milk, centrifugal.
Beet pulp, dried.		Tankage, over 55 per cent protein.
Molasses, cane.		Dried blood.
		Distillers' grains, dried, from corn.

ROUGHAGE.

Dry roughage.	Succulent roughage.
Corn fodder.	Corn fodder.
Corn stover.	Sweet sorghum fodder.
Sorghum fodder, dry.	Green millet, common or Hungarian.
Millet hay, common or Hungarian.	Mangels.
Timothy hay.	Rutabagas.
Clover and wild grass hay.	Corn silage.
Oat straw.	Alfalfa, green.
Alfalfa hay.	Red clover, green.
Red clover hay.	Cowpeas, green.
Soybean hay.	Soybeans, green.
Peas and oats hay.	Peas and oats, green.
Cowpea, hay.	Rape, green.
	Field pea silage.

In feeding cows the usual rule is to feed the roughage that is available and to use what concentrates may be available on the farm, buying enough others to complete a suitable ration. It will be assumed in this case that there are available clover hay, corn silage and corn-and-cob meal. Therefore it will be necessary to select two other concentrates. A good rule is to select for a dairy cow equal parts by weight of high, low and medium protein concentrates in order to provide concentrates that will provide sufficient protein. By following this rule the rations could be made up as follows: 10 pounds red clover hay; 30 pounds corn silage; 3 pounds corn-and-cob meal; 2 pounds wheat mixed feed; 3 pounds gluten feed; 1 pound oil meal. By following these rules in general innumerable combinations may be made under different conditions of home supply.

A Ration for a Horse Weighing 1,000 Pounds Doing Medium Work.— Observing the general rule given above as to the amount of feed necessary for horses at work the following is given as a typical ration: 12 pounds timothy hay; 8 pounds oats; 4 pounds corn. Rations for horses do not require as much protein as rations for cows. The feeds used are generally limited to timothy, clover, alfalfa and mixed hays and to barley, corn, oats and hominy for concentrates with molasses sometimes added when cheap enough. The only high protein food used in any quantity for horses is linseed oil meal.

Beef Cattle Ration.—A ration is desired for a 1,000-pound steer. The following is suggested: 10 pounds red clover hay; 40 pounds corn silage; 4 pounds corn-and-cob meal; 2 pounds oats (ground); 3 pounds gluten feed. As the steer became fatter and nearer the time for selling the silage should be cut down and the amount of corn increased. Practically all of the feeds listed under the ration for a cow can be used for steers. Less of the high protein feeds are needed because the gain of protein in the body is less than the protein put into the milk.

A Ration for Breeding Ewes with Lambs.—A ewe of the large breeds will weigh about 125 pounds. A pen of eight would make 1,000 pounds. The following ration is suggested for each group of eight to be fed: 12 pounds red clover hay; 25 pounds turnips; 5 pounds ground oats; 5 pounds cornmeal; 3 pounds wheat bran; 1 pound oilmeal. The feeding of milking ewes is practically the same as feeding small dairy cows. Sheep are particularly fond of turnips. If turnips are not available 16 to 20 pounds of corn silage or pea vine silage could be substituted. Also it will be noted that less high protein feeds are necessary.

In feeding lambs for market it is a general practice to limit the amount of succulent feed a little more than in feeding ewes for milk production. The basis of fattening rations is practically always a large percentage of corn grain, which must be supplemented with good roughage and one high protein feed. Legume hays and roots for the roughage and linseed oil meal for the high protein concentrate make an ideal combination with corn in all fattening and growing rations.

A Ration for Fattening Pigs.— It will be assumed that pigs weigh 125 pounds each when they are about half fattened for market. It would then take eight of them to weigh 1,000 pounds live weight. The following is suggested as a good ration at this point: 20 pounds cornmeal; 16 pounds flour wheat middlings; 2 pounds tankage.

It is intended, in a ration such as the one just given, that the grain shall be fed as a slop mixed with water. The corn might be fed whole. If skimmed milk or buttermilk were available, of course less middlings and no tankage would be necessary. The feeds used for pigs are not so numerous as those used for dairy cattle. The one thing to avoid in rations for pigs is a feed that is too high in fibre. Brood sows like some succulent feed and will consume rather large quantities of alfalfa or clover hay if it is kept before them in a rack. Through the feeding of hay money may be saved in the purchase of concentrates. In the feeding of pigs and sows in the summer time much larger gains can be made and feed saved if the pigs and sows are kept on good pasture.

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LIVEING, George Downing, English chemist and surgeon: b. Nayland, Suffolk, 21 Dec. 1827. He was graduated at Saint John's College, Cambridge, in 1850, and in 1853 he became a Fellow and lecturer in natural science in that college. He was appointed professor of chemistry at the Royal Military College, Sandhurst, in 1860; and from 1861–1908 professor of chemistry in the University of Cambridge. In 1911 he was appointed president of Saint John's College, Cambridge. In 1852 he established at his own expense the first chemical laboratory for undergraduates in Cambridge and may be said to be the founder of the system of experimental teaching that is now such a prominent feature of that university. He was instrumental in securing the examination and inspection by the university of secondary schools and the admission of girls' schools to the examinations. He has published 'On the Transmutation of Matter' (Cambridge Essays, 1st series, 1855); 'Chemical Equilibrium the Result of the Dissipation of Energy' (1885); 'Report on the University Colleges' (with Mr. Warren, 1897); and many papers on spectroscopy, crystallization, etc., in the scientific proceedings of various scientific societies.

LIVER. The liver is the largest glandular organ of the body. In man it is situated on the right side of the abdominal cavity immediately beneath the diaphragm. Its weight in the adult is approximately from three to four pounds, and its size is roughly indicated by the following measurements: Greatest diameter about 12 inches, anteroposterior diameter about seven inches, thickness at different parts from one to three inches. The organ is divided into five lobes, of which the right and left are the principal ones; the former comprising the greatest part of the bulk of the entire organ. On the under surface may be seen a square lobe lying anteriorly between the right and left lobes and known as the quadrate lobe. In a similar position between the right and left lobes at the posterior part of the organ is the Spigelian lobe, while a bridge-like lobe extending from the latter to the right lobe is known as the caudate lobe. The upper surface of the right and left lobes is convex and fits into the arch of the diaphragm. The lower surface of the organ is more or less concave and is divided by five fissures. Of these a longitudinal furrow extends from the anterior to the posterior border of the organ separating the right from the left lobe; a transverse fissure extends at right angles from this at a point somewhat nearer the posterior than the anterior surface; it divides the longitudinal fissure into an umbilical fissure in front (so called on account of its lodging the umbilical vein in the fœtus) and the fissure of the ductus venosus behind (on account of its lodging the ductus venosus in the fœtus). Between the lobus Spigelii and the right lobe of the liver is the fissure of the inferior vena cava, lodging that vein, while at the anterior edge of the organ at the side of the quadrate lobe is a fissure which accommodates the gall-bladder. The transverse fissure is the most important, as it serves for the entrance into and emergence from the organ of the blood vessels, nerves and hepatic ducts.

The liver is held in place by five ligaments, four of which are simple folds of peritoneum, while the fifth, or ligamentum teres, is a round cord formed by the obliteration of the umbilical vein and extending from the anterior edge of the liver at the notch between the left and right lobes to the umbilicus and along the under surface of the liver to its posterior border. The peritoneal folds which serve the purpose of ligaments are a longitudinal one extending on the upper surface of the organ from the notch in front to the posterior border, a coronary ligament which is found along the posterior border, and a right and a left lateral ligament. These peritoneal reflexions serve to hold the organ in place, keeping it more or less firmly in apposition with the diaphragm.

The blood vessels entering the liver are the hepatic artery and the portal vein; the former being a branch of the cœliac axis, the latter being the large venous trunk which is formed by the union of the superior mesenteric and splenic veins. Both the hepatic artery and portal vein divide in the transverse fissure into two parts, a right and a left, which enter the substance of the right and left lobes, respectively.

The hepatic veins are the efficient veins of the liver conveying the blood from this organ into the inferior vena cava. In addition to these vessels, the liver, like other organs, is supplied with large and numerous lymphatics. The nervous supply of the organ is derived from the left pneumogastric, the hepatic plexus of the sympathetics and from the right phrenic nerve. The bile ducts and hepatic ducts will be described below.

The gall-bladder is a small pear-shaped sac lying on the under surface of the liver. At its narrow end it opens into a small duct (cystic duct) which passes back and down to join the hepatic duct forming the common bile duct, which terminates in the duodenum. The gall-bladder is the reserve sac in which bile is stored and by the contracting of which a uniform flow of this liquid is maintained.

Structure of the Hepatic Substance.— The substance of the liver is made up of lobules of more or less equal size, separated by areolar connective tissue, which is a continuation of the fibrous covering of the organ or *capsule of Glisson*. In these fibrous septa between the lobules are found the larger blood vessels, biliary ducts, lymphatics and nerves. The lobule under a low power of the microscope is seen to be composed of radiating columns of liver cells converging to a central point in which is situated a large vein (intralobular vein) belonging to the system of the inferior vena cava. The columns of liver cells branch and anastomose with each other, and between them are spaces occupied by blood capillaries and the primary biliary passages. The liver cells themselves are polyhedral in shape and are so arranged that a capillary space, known as the biliary capillary, is left between them. The capillary blood vessels are similarly formed by the peculiar juxtaposition of the liver cells, leaving spaces in which the capillary blood vessels extend from the terminal branches of the portal vein in the septa at the periphery of the lobules to the central vein already mentioned. The latter, collecting the blood from the capillary system, transports it to larger vessels known as sublobular veins, which finally unite and form the hepatic veins and discharge the blood into the inferior vena cava. The hepatic arteries and their terminal branches occupy the septa and supply blood to the connective tissue constituting the septa and to the walls of the portal veins and biliary ducts. The venous blood of this distribution is discharged into the terminals of the portal vein within the septa.

At the periphery of the hepatic lobules, the epithelial cells of the hepatic columns continue directly into the smaller bile ducts which are situated in the interlobular septa. These primary bile ducts unite to form larger ducts and finally a right and left hepatic duct emerging from the transverse fissure unite to form a common bile duct. This is further joined by the *cystic duct* or duct of the gall-bladder and it terminates in the duodenum in a common orifice with the pancreatic duct.

The structure of the liver is such that the blood entering through the portal circulation comes in contact with the liver cells on one side while the capillary biliary passages are on the other side of the hepatic cell.

The lymphatic vessels accompany the portal vein and hepatic artery and another system accompanies the branches of the hepatic vein. The capillaries penetrate into the lobules, passing between the hepatic cells.

Functions of the Liver.— The physiological functions of the liver are probably very numerous and are but imperfectly understood. In the fœtus the liver is an important source of the red blood cells, reversing the process of adult life in which they are destroyed by the formation of bile. The position of the organ indicates that one of its important functions is the elaboration of materials presented by the blood coming from the gastro-intestinal tract, and probably also the purification of this blood.

As far as they are known, the functions of the organ may be divided into the *metabolic* and *biliary*.

Metabolic Functions.— It is known that the liver acts upon sugars and other carbohydrate materials to convert them into glycogen which is stored up by the hepatic cells. This accumulates during digestion and is utilized in the intervals, so that the percentage of sugar in the blood is kept at an approximately uniform standard. It is known that in certain diseases (for example, diabetes), the function is greatly disturbed with resulting consequences that affect the general health. The liver shares with the muscles of the body this glycogenic function. It also has the function of removing or neutralizing certain toxins and of removing certain metallic salts.

Another important metabolic function is that of forming urea, the final stage in the metabolism of albuminous food. Uric acid also is to some extent formed in the liver but is more particularly the product of the lymphatic organs and tissues.

Biliary Function.— The formation of bile is one of the important attributes of the liver, though possibly this function is less predominating than has hitherto been believed. The bile is an albuminous liquid containing bile pigments (bilirubin, biliverdin), bile salts (glycocholate and taurocholate of soda), nucleo-albumin, cholesterin, fat and other less important substances including various salts. The bile is secreted more or less intermittently, the amount being greatest about the middle part of the day and increasing after meals. The daily output is from one to two pints. Its functions are numerous. Among other properties it aids in the absorption of fatty foods, stimulates intestinal peristalsis and prevents intestinal fermentation, and is the vehicle of excretion from the body of certain waste products, notably hemoglobin. It is known that bacteria and other minute foreign bodies are discharged from the system through this medium.

Authorities are divided as to the amount of the work which the liver performs in the production of sugar. Bernard believes that the glycogen is a reserve of carbohydrates, making the deduction from the fact that the liver is found to contain more glycogen than any other organ and that after death the glycogen is replaced by sugar. Another authority, Pavy, is of the opinion that the liver forms no sugar, but uses it in the form of glycogen. Still another, Seegen, declares that sugar is formed in the liver and not from glycogen but from protein and fat. As the blood normally has about 0.15 per cent of sugar, an amount which is cut in half, if the action of the liver is removed from the circulation, it is considered reasonably good evidence that the sugar in the blood comes either from the liver or from some other product formed in the liver. Also the amount of sugar in the blood does not normally rise above 0.3 per cent without overflowing through the kidneys into the urine, which shows that the amount of sugar that can be destroyed by the liver is limited. The liver thus permits the accumulation and storing of this valuable material which would otherwise be lost. If sugar in the form of a glucose solution is introduced into the blood in such a way as not to pass through the liver, it is immediately discharged via the urine, while if it is so injected as to pass into the liver first, a comparatively large quantity remains there.

Diseases of the Liver.— The diseases of the liver may be classified under the following heads: Derangements of the Circulation; Nutritional and Inflammatory Disease of the Substance of the Liver; Tumors; Parasitic Diseases; Functional Disturbance.

Circulatory Disturbances.— *Congestion of the Liver* is an increase in the volume of blood in the organ. This may be transient or more or less permanent.

(*a*) Transient congestion follows the ingestion of food and drink, especially when these are of stimulating quality such as alcoholic beverages, spiced and rich foods. It is also occasioned by circulatory activity, such as accompanies malarial and other fevers and other conditions of systemic excitement. In these cases the increase of blood in the liver is the result of an excessive supply of blood to the organ.

An excess of blood in the liver frequently occurs after a flow of blood, such as that of menstruation, has been stopped, or when, through catching cold or even because of some nervous condition, such flow of blood, or a blood flow that has been caused by hemorrhoids, has been stopped.

(*b*) Passive congestion is the form in which the outflow of blood from the liver is interfered with. This form is likely to be more or less durable or permanent. Among the causes, most important are diseases of the heart and the lungs, or any other cause of obstruction to the circulation in the thorax.

It is said that malaria is the most frequent occasion of an attack of congestion of the liver and that it occurs most frequently in autumn and in persons of middle age.

Pathological Anatomy.— In active or acute congestion no marked alteration is observed on examination of the organ. In passive congestion the liver becomes enlarged, and the central veins within the lobules are seen to be increased in size, while the peripheral parts of the lobule often become light-colored from degeneration of the liver cells. This gives the surface of section of the organ a peculiar appearance that this has been well designated «nutmeg liver.» When passive congestion is long continued, the hepatic cells, compressed by the dilated blood-vessels and otherwise disturbed in their nutrition, undergo atrophy, while at the same time some fibrous tissue growth replaces the degenerated hepatic cells, and the whole organ becomes darker in color from deposit of pigment from the stagnated blood. The result is that the organ decreases in size, becomes harder and of a darker color than normal. The term *cyanotic or red atrophy* is given to this condition.

The symptoms of congestion of the liver vary with the kind, the degree and stage of the disease. In acute congestion, such as follows over-indulgence in stimulating food and drink, a sense of heaviness in the region of the liver, and perhaps slight disturbances of digestion with general malaise constitute the symptomatology. In chronic or passive congestion, such as accompanies heart disease, the symptoms are quite distinctive. The organ increases in size so much that it is easily felt in the upper part of the abdominal cavity and it becomes tender or even acutely painful. Digestive disturbances are very common, partly as the result of the condition of the liver itself and partly as the result of the underlying condition which occasioned the congestion of the liver. Among these digestive symptoms, loss of appetite, difficult and painful digestion, nausea and vomiting are the most conspicuous. When the congestion of the liver is pronounced, more or less jaundice occurs. This results from the thickening of the walls of the biliary ducts and the compression of the finer biliary channels by the swollen state of the organ. In marked cases, the jaundice may be intense; usually it is slight.

In the last stages of congestion of the liver when the organ has undergone cyanotic induration, the symptoms may be similar to those of cirrhosis (q.v.).

Treatment.— The treatment of congestion of the liver is directed primarily toward the relief of the condition which causes the congestion. In heart diseases, cardiac tonics are important. Sometimes a prompt relief is obtained by venesection. Depletion from the portal circulation by brisk purgation may also be efficacious, and regulation of diet is important as the congested organ is less able to withstand injurious effects of stimulating foods or drink than the healthy liver.

Diseases of the Substance of the Liver.— Among these may be considered: (1) Simple atrophy; (2) acute yellow atrophy; (3) fatty liver; (4) cirrhosis, and (5) abscess.

Simple Atrophy of the Liver occurs in cases of starvation or inanition from long-continued disease. *Pressure atrophy* is found in cases of deformities of the chest, in which the ribs are pressed inward against the liver, as a result of tight lacing and the substance of the organ does not change very greatly in atrophy, though the individual liver cells are smaller than normal and usually somewhat pigmented. The shape of the liver is often peculiar. In the case of deformities of the chest, the pressure exerted by the ribs may cause deep grooves in the surface of the liver, or there may be a single transverse furrow at the lower margin of the ribs where this is pressed against the organ.

The function of the liver is probably not seriously impaired in any of these cases, though some disturbance undoubtedly occurs.

Acute Yellow Atrophy is a disease in which the liver is decreased in size, often to a remarkable degree. It is soft and on transverse section the substance is of a light yellow color with mottled areas of reddish or purplish hue, the latter being portions in which the substance is congested or in which hemorrhages have taken place.

Changes are found also in various other tissues of the body, showing that acute yellow atrophy is not wholly a disease of the liver but a general infection or intoxication, having its most marked manifestations in the liver.

Symptoms.—After a period of indefinite digestive disturbances, acute jaundice and marked nervous symptoms set in. The patient also becomes delirious, and sometimes comatose. In the course of 10 days or two weeks the disease in a large percentage of cases terminates fatally. The treatment consists in stimulation or other measures called for by the general condition.

Fatty Liver.— There are two varieties of fatty disease of the liver, that known as *infiltration* and that termed *fatty degeneration.* In the former there is a deposition of fat in the liver cells, similar to that which is found in the subcutaneous tissues in ordinary obesity. In the latter the liver cells undergo destruction with formation of fat. Fatty infiltration may be the result of excessive supply of nutriment as in ordinary obesity, and is also found in certain states of general weakness and wasting, particularly in association with diseases of the lungs. In the latter cases, the cause is to be found in the deficient consumption of fat, owing to diminished oxygenation. Fatty degeneration may be caused by various infectious diseases, but is more particularly the result of poisoning with phosphorus, arsenic, mercury and other poisons.

In fatty infiltration, the liver is enlarged, lighter than the normal organ in specific gravity and in color, and on section with a knife the increased fat is indicated by an oily character of the cut surface. In fatty degeneration the liver is usually diminished in size and the substance is of a friable softened character.

Cirrhosis of the Liver is the most frequent and important of the diseases of this organ. It is essentially a replacement of normal liver tissue by connective tissue, causing more or less hardening.

The causes of cirrhosis of the liver are numerous, though one in particular occupies a very prominent position on account of its frequency. The cause referred to is over-indulgence in alcohol, especially raw spirits, whence the terms alcoholic liver, gin drinker's liver, etc. It must not be supposed, however, that alcohol is the invariable cause. Over-eating, gouty conditions, syphilis and various other infectious diseases may be followed by cirrhosis entirely like that caused by alcohol. It has been noted in the description of congestion of the liver that a form of cirrhosis (cyanotic induration) results from long-standing congestion. Sometimes cirrhosis of a peculiar type is caused by obstruction of the biliary ducts. This produces a stagnation of the bile and an irritation of the substance of the liver that terminates in the formation of connective tissue.

Pathological Anatomy.— Two forms of cirrhosis of the liver are recognized. One known as the *atrophic,* in which the liver is decreased in size; the other, *hypertrophic,* in which the organ is increased in size. In atrophic cirrhosis (hob-nail liver, granular liver), the organ has an irregular nodulated or granulated surface, the irregularities being caused by the contractions of the connective tissue which forms the basis of this pathological state of the organ. It is very firm, and on section the increased connective tissue can be recognized in the form of more or less distinct septa interlacing the lobules or groups of lobules of the liver substance. The lobules and groups of lobules are compressed by the contracting connective tissue, and as a result undergo atrophy and degenerative change. The connective tissue formation which is characteristic of this form of cirrhosis is found in the interlobular tissues surrounding the terminal branches of the portal vein. Consequently the portal circulation is obstructed, and congestion of the various abdominal organs whose blood is discharged through this circulation results. When cirrhosis has proceeded for some time, new channels of circulation may be established, by which the congestion of the abdominal organs is relieved. There results from this visible enlargement of the veins of the abdominal walls an increased size of the veins in the lower end of the œsophagus and in the rectum.

Hypertrophic cirrhosis of the liver is a form in which the liver is increased in size. The surface is usually smooth and the substance of a uniform character. This is due to the fact that the new connective tissue is uniformly distributed within as well as between the liver lobules. This form of disease may be the result of the same causes as the atrophic variety, but is more commonly due to obstructions of the flow of bile. Very commonly interference with the discharge of bile is found in this form, as interference with the circulation of blood is characteristic of the other variety.

Symptoms.— The symptoms of cirrhosis of the liver in earlier stages are very obscure and uncertain, but frequently include a pallor and sallowness with peculiarly muddy complexion. Later interference with the portal circulation causes congestion of the mucous membrane of the stomach and intestines, with resulting disturbances of digestion, such as dyspepsia, vomiting, constipation and even hemorrhages from the stomach or bowel. There is also a thinness and emaciation with drawn and occasionally bloated face, sunken eyes with discolored whites. The spleen is enlarged from congestion of its substance, the abdomen is distended forming a marked contrast to the fleshless face and limbs, and the last phase of the disease is marked by dropsical effusion in the abdominal cavity (ascites). Cirrhosis of the liver is a chronic disorder which may extend over a period of many years and which may be arrested even after it has reached an advanced stage. Among the symptoms of hypertrophic cirrhosis are tenderness and increase in the size of the liver, the development of jaundice, and sometimes the occurrence of fever. The disease is more rapid in its course than the atrophic variety.

Treatment.—The treatment of this condition is preventative rather than curative. When due to alcohol it may be arrested if not too well advanced, by a control of the habit of drinking; and a restitution of normal conditions may be favored by careful diet, including mainly the avoidance of stimulating or irritating food, and of general excesses of diet. The use of saline waters may be beneficial. When advanced to the stage of dropsy of the abdominal cavity, depletive measures, such as are used for the relief of dropsies in general, may be useful; or it may be necessary to remove the liquid by tapping.

Abscess of the Liver may result from dysentery and other ulcerative conditions of the intestines, in which cases the abscess is likely to be solitary; or it may accompany a septicæmia originating in the abdominal cavity from some local disease like appendicitis or puerperal infection, in which case multiple small abscesses are found throughout the substance of the liver. Another variety of multiple abscess is that in which obstructions of the biliary ducts by gallstones occasion retentions of bile and the formation of local foci of suppuration. Abscess is more common in tropical countries, probably on account of the greater frequency of dysentery in such localities.

Pathological Anatomy and Symptoms.— The liver is enlarged, and sometimes a projecting mass can be seen in the upper right portion of the abdomen. The abscess may be of small size, but frequently reaches very considerable proportions, containing perhaps a pint or more of thick pus. It may discharge externally through the skin, into the abdominal cavity or some of the abdominal organs, and even through the diaphragm, into the lung and bronchi. Occasionally a spontaneous cure results in this way. More commonly the patient perishes before the abscess ruptures, from general infection or from prostration. The disease is frequently attended with great pain, with jaundice and with irregular fever.

Treatment.— The only effective treatment of abscess is surgical operation.

Tumors.—Among the tumors of the liver, the most important is cancer. This is usually secondary to cancer of the stomach or intestines. It may, however, be primary in the liver. The liver is found enlarged and its surface irregularly studded with nodules varying in size from that of a pea to that of an apple, or even larger masses.

Symptoms.— The important symptoms are profound disturbance of general health with emaciation, such as characterize cancer in any part of the body; pain in the region of the liver, and increase in the size of the organ; jaundice of intense and lasting character; and occasionally dropsy of the abdominal cavity.

Parasitic Diseases.— The most important of these is the ***hydatid cyst***, which results from the lodgment of the embryo of the Tenia echinococcus, a tapeworm occurring in the adult state in the intestines of dogs and some others animals. The eggs of this tapeworm are communicated by the dog to the human through drinking water or fresh vegetables. As all of the blood from the enteric canal passes through the liver the parasite embryo is generally lodged there. Fortunately this disease is rare in North America. In man the larval condition alone is met with. The embryo in the liver becomes surrounded by a capsule in which a light liquid collects and thus a *cyst* is formed. Secondary cysts (daughter-cysts) may develop within the original one and thus a large cavity filled with smaller spherical cysts may result. The liver increases in size and the cyst may be visible, or it may be felt through the abdominal walls as a resilient projecting mass. The hydatid cyst may subsequently contract by absorption of its liquid contents or it may rupture in the same manner as an abscess. The symptoms of this disease are frequently obscure, but jaundice (from pressure on the bile ducts), dropsy of the abdominal cavity from pressure on the portal vein and other "mechanical" symptoms may occur.

Jaundice is a functional disturbance of the liver in which the biliary coloring matter is absorbed by the blood and deposited in the tissues of the body. Jaundice may result from any cause of obstruction of the outflow of the bile through the biliary ducts or from any serious disease of the liver substance, such as abscess, cancer, acute yellow atrophy, etc. Various poisons and infectious diseases cause jaundice by their destructive action on the liver.

The most frequent form of jaundice is that known as *simple catarrhal jaundice,* which results from digestive disturbances, especially such as follow great excess in eating or drinking and exposure to cold. In this variety, the outflow of the bile is impeded by swelling of the mucous membrane of the duodenum where the common bile duct discharges, and also by swelling of the lining membrane of the larger bile ducts themselves. When the bile formed within the liver cannot find normal discharge, it is absorbed into the blood, and finding its way to various parts of the body discolors these, causing the yellow appearance of the skin and mucous membranes which characterizes the disease.

Symptoms.— The symptoms of catarrhal jaundice are, in the first place, those of intense disturbances of digestion, such as great pain in the region of the stomach, nausea and vomiting; later, the appearance of a yellowish discoloration of the skin and mucous membranes. The fæces become light-colored from the absence of biliary coloring matter, and in advanced cases they are actually a light clay color or even white. The urine becomes dark brown or greenish in color. The patient is depressed, often even melancholy. The pulse is slow; the temperature as a rule is depressed, though there may be a moderate degree of fever.

Treatment.— Careful dieting is an essential in the treatment. The patient must abstain from food entirely at first, and later take the less irritating of foods, such as milk, broths and the like. Bismuth, pepsin, small doses of calomel and salines are administered to improve the state of digestion and lessen the congested condition of the stomach and duodenum. Drastic purgatives are harmful. Warm applications over the region of the liver are efficacious. The disease usually subsides in a few days or in a week or two.

Gall-stones.— Gall-stones are usually formed within the gall-bladder; very rarely in the biliary ducts within the liver. The gall-stone consists of biliary pigment matters, but in some cases almost wholly of one of the constituents of bile, cholesterin. On section through a gall-stone, a central nucleus may be seen which is composed of epithelial detritus and inspissated mucus, together with bacteria in many cases. Around this is deposited cholesterin or biliary pigment. The gall-bladder may contain a single stone or, more commonly, a number, and sometimes even hundreds are found.

Gall-stones are more common in women past middle life than in younger persons or in the male sex.

Symptoms may be wanting until a stone enters the cystic duct and becomes lodged in the latter, or passing through this, becomes obstructed in the common bile duct, and causing what is known as biliary colic. The patient is seized with intense pain, radiating to the right and to the back, sometimes as high as the right shoulder. Vomiting and other reflex disturbances and even collapse may occur. When the stone lodges, jaundice is the most pronounced symptom. Frequently the gall-stone passes with some effort and the paroxysm is relieved. Sometimes this relief is brought about by a recession of the stone into the gall-bladder.

Treatment.— The treatment of gall-stone consists of careful diet and the use of saline waters to improve the digestive conditions and render the bile as liquid as possible. Gall-stones may thus be diminished in size and enabled to pass through the ducts. During the paroxysm of biliary colic, remedies to relieve pain are imperatively necessary. Hypodermic injections of morphine and even narcosis with ether or chloroform may be required. Surgical operation for removal of the stone is often desirable.

LIVER-LEAF, or **NOBLE LIVERWORT.** See HEPATICA.

LIVER OILS. See OIL.

LIVERMORE, Mary Ashton Rice, American reformer and lecturer: b. Boston, Mass., 19 Dec. 1821; d. Melrose, Mass., 23 May 1905. She was married in 1845 to Rev. D. P. Livermore, a Universalist minister (d. 1899), and was early in life active in the anti-slavery and temperance movements. In 1862 she was appointed agent of the Northwestern branch of the United States Sanitary Commission at Chicago, and after the Civil War period was conspicuous in her efforts to promote the woman suffrage and temperance movements. With Frances E. Willard she edited *American Women.* Among her popular lectures are 'What Shall We Do with Our Daughters?'; 'Women of the War'; 'The Moral Heroism of the Temperance Reform.' She is the author of 'Pen Pictures' (1865); 'Thirty Years Too Late' (1878); 'My Story of the War' (1888); 'The Story of My Life' (1897), etc.

LIVERPOOL, Charles Jenkinson, 1st Earl of, English statesman: b. Winchester, 26 April 1727; d. London, 17 Dec. 1808. He was educated at Charterhouse School, and later entered University College, Oxford, whence he was graduated M.A. in 1752. In 1760 he became private secretary to Lord Bute; in 1761 he was elected to Parliament and during the same year was appointed to the post of Under Secretary of State; in 1763 became joint Secretary of the Treasury; was made Lord of the Admiralty by the Grafton administration in 1766; became one of the vice-treasurers of Ireland in 1772; Master of the Mint 1775, and Secretary of War under Lord North 1778-82. He was appointed by Pitt in 1783 a member of the Board of Trade and continued to serve in that body till 1801, from 1786 serving as its president, but he did not enter public life from the time of his retirement from the Board till his death. In 1786 he became president of the council for trade and the plantations, and the same year Chancellor of the duchy of Lancaster, and was created Baron Hawkesbury, and Earl of Liverpool 1796. His association with Lord North in the closing years of the American War made him for a time very unpopular; but this he outlived, and he took a prominent part in arranging the first commercial treaty with the United States. He published, among other works, 'Discourse on the Conduct of

Government Respecting Neutral Nations' (1758); 'Collection of All the Treaties of Peace between Great Britain and Other Powers from 1648 to 1783' (3 vols., 1785); 'A Treatise on the Coins of the Realm' (1805), etc.

LIVERPOOL, Robert Banks Jenkinson, 2d Earl of, English statesman: b. London, 7 June 1770; d. there, 4 Dec. 1828. He was the eldest son of Charles Jenkinson, 1st Earl of Liverpool (q.v.). He was educated at Charterhouse School and Christ Church College, Oxford, 1786–89; in the latter year traveled in Europe, reaching Paris during the French Revolution and witnessing the fall of the Bastile. He was elected to Parliament in 1790; in 1803 was created Baron Hawkesbury; and in 1808 upon the death of his father succeeded to the title of Earl of Liverpool. In Parliament he was prominently identified with the Tories; for seven years was a member of the India Board; in 1799 became Master of the Mint; and in 1801 became Foreign Minister in the Addington Cabinet, and while in that office negotiated the Treaty of Amiens with Napoleon. On 12 May 1804, when Pitt was returned to power, he accepted the office of Home Secretary and became leader of the House of Lords and held that post until Pitt's death. During the Whig ministry of 1806–07 he led the opposition, but on 25 March 1807 was again appointed Home Secretary in the Portland administration; and Secretary of War and the Colonies, 1809–12. He held various portfolios during Perceval's administration and when the latter was assassinated in 1812 became Premier and continued to direct English affairs until April 1827, when a stroke of paralysis forced him to resign office. He opposed the Roman Catholic emancipation movement and the reform of Parliament and his term of office was marked for a time by a somewhat retrograde policy on the part of the ministry and widespread discontent among the people. Public finances were criticized as being poorly administered; the duty on imported grain was increased; and the policy of forcible repression was followed by him till 1826, but from that time he sought to modify and reform the burdensome Corn Laws. He was instrumental in sending Napoleon to Saint Helena and in readjusting French affairs in 1815 and 1818. Without being a man of eminent talents, he was possessed of unfailing tact, good temper and an instinct for practical solutions.

LIVERPOOL, England, a city, municipal, county, and parliamentary borough, and seaport, on the right bank of the Mersey, three miles from the sea, and extending about eight and a half miles along the east side of the river. It is the second seaport of the British Empire, and is fourth in population among the cities of the United Kingdom. The port of Liverpool extends from Hoylake, at the mouth of the river Dee, along the Cheshire coast of the river Mersey to Ince Ferry, and from Dungeon Point on the Lancashire coast of the river to Formby Point at its mouth. Liverpool is (by rail) 201 miles northwest of London, 251 miles from Harwich (northwest), 92 miles from Birmingham (northwest), 34 miles from Manchester (west), 96 miles from York (southwest), 124 miles from Hull (southwest), and 227 miles southwest of Edinburgh.

Area.— The area of the city is 16,642 acres (23 square miles); the ratable value £4,470,837. The population in 1905 (officially estimated) was 730,143. The following statistics of population will show the comparatively rapid growth of the city: 11,833 (1720); 35,600 (1770); 77,708 (1801); 376,065 (1851); 517,980 (1891); 684,958 (1901); 746,421 (1911). The great advance in the population in later years indicated by these figures is partly explained by the extension of the city boundaries so as to take in several adjoining townships.

Divisions.— The city is divided into nine parliamentary divisions returning nine members to Parliament; and into 35 wards, returning 137 members to the city council.

Public Buildings.— Down to the middle of the 19th century Liverpool contained very few public buildings; the streets were narrow and architecturally unattractive. During the last 60 years a complete change has taken place, and within a radius of half a mile from the town-hall the city has been rebuilt; new streets have been made, and old ones widened. The following are amongst the most important of the public buildings:

Saint George's Hall, opened 1854, cost £328,500; town-hall, 1795, cost £170,490; municipal offices, 1867, cost £141,170; post office, 1899, cost £400,000 (including site); Picton Reading-Room, 1878, cost £20,000; Central Technical Schools, 1901, cost £110,000; University buildings, cost £220,000 (including sites). The William Brown Library and Museum (1860) and the Walker Art Gallery (1877) were the gifts of the generous citizens whose names they bear. The Anglican Cathedral, begun in 1904, will, when completed, be one of the most imposing ecclesiastical buildings in the British Empire. The Royal Infirmary, the Blue Coast Hospital and the Seamen's Orphanage are handsome buildings devoted to the cause of charity.

Many of the buildings associated with commerce have been designed by some of the foremost architects of the day and must be ranked amongst the finest in the city.

With the completion of the three great buildings now in progress, viz.: the cathedral, the dock offices and the cotton exchange, Liverpool, from an architectural point of view, will be unsurpassed by any provincial city or town in the United Kingdom.

Libraries.— The free public libraries of the city consist of one large central reference library (already referred to) and 11 lending libraries and reading-rooms. An extension of the reference library has been made to receive the Hornby collection of art books, prints and autographs. Other important libraries in the city are the Athenæum (founded 1798), The Liverpool Library (founded 1758), and The University (founded 1881). There are also special theological, legal and medical libraries.

Art Gallery and Museums.— The famous collection of pictures in the Walker Art Gallery is extremely valuable, and contains works by Burne-Jones, Herkomer, Holman Hunt, Leighton, Millais, Albert Moore, Poynter, Briton Riviere, D. G. Rossetti and others. Modern sculpture is also well represented. An autumn exhibition is held annually when the most important pictures of the year are placed on view. The public museums containing archæological, ceramic and natural history collections (the latter including an aquarium) are amongst the most popular institutions in the city.

Places of Worship.— The bishopric of Liverpool was founded in 1880, when an endowment of £100,000 was raised by public subscription. There are over 100 churches in the city (which does not comprise the whole of the diocese). The various Non-Conformist denominations have amongst them about 190 places of worship.

Education.— The city possesses an efficient system of education. The elementary, secondary and technical schools are under the control of the city council. There are a considerable number of scholarships to enable students to pass from the elementary to the secondary schools and on to both the Liverpool University and the universities of Oxford and Cambridge.

The Liverpool University was first established as a college in 1881, and obtained its charter as a university with power to confer degrees in 1903. The teaching staff numbered in 1914 138 members, with 700 students. The university is endowed both for teaching and research and connected with it is the famous School of Tropical Medicine.

Water, Electricity and Tramways.— The city and district are supplied with fresh water from Rivington in Lancashire, and Lake Vyrnwy, Montgomeryshire (Wales). The engineering difficulties connected with the supply of water from such distances have been very great and the cost proportionately heavy. The total cost of the water undertaking has been £6,586,793. There is a total capacity of 70,000,000 gallons per day, and the daily consumption in the city is about 40,000,000 gallons. In 1896 the corporation purchased the works and rights of the Liverpool Electric Supply Company at a cost of £400,000. Since that date the demand for electricity for light and power has rapidly developed and the undertaking has proved financially successful. The total capital expenditure was, on 31 Dec. 1904, £1,719,000. For many years a portion of the profits has been contributed to the rates of the city. In 1904 the amount so contributed, after paying all working expenses, charges for interest and sinking fund, was nearly £17,000.

In 1897 the corporation decided to purchase the tramways, which down to that date had belonged to a limited company. The amount paid was £567,375. The overhead trolley system of electric traction was quickly substituted for the horse system hitherto in use. New routes were opened up, streets widened, the length of track nearly doubled and fares reduced. The length of track is now over 116 miles and the average length of the penny stage two and one-half miles. The introduction of "first-class" cars at enhanced fares has been attended with success.

Insanitary Houses.— During the past 40 years the corporation has spent large sums of money in the demolition of insanitary cottage property, and in the reconstruction of artisans' dwellings. The city is also well provided with public baths, the oldest in the kingdom, being established in 1794, including open air baths (free), and in the poor quarters of the town there are corporation buildings efficiently equipped for public laundry work.

Parks, Etc.— The city possesses a number of fine parks, gardens and recreation grounds. The total number of acres thus allotted to public use is about 1,200 — including Sefton park with 269 acres, the cost of which, including the laying out, was £410,269. About 100 acres of the above represent churchyards, and plots of land varying in size from one-fourth of an acre to three acres, which have been turned into gardens and recreation grounds, thus greatly improving the appearance of many localities and adding to the pleasure of the inhabitants.

All the land here referred to has not been purchased by the corporation. The Wavertree playground, 108 acres, was the gift of a generous citizen, and cost about £100,000; while the Roby estate (100 acres), situated on the eastern boundary of the city, was donated by Alderman Bowring and dedicated to the use of the citizens. The estate of Calderstones, south of the city, is the most recent purchase.

Hospitals.— The medical charities are on a very extensive scale. Some of the charities are old, but all are now housed in modern buildings possessing all the latest scientific requirements. Most of the charities are maintained by endowments and public subscriptions, but seven of the largest hospitals in the city have been built and are maintained by the corporation, and in 1904 the sum of £46,000 was expended in their administration. In addition to the hospitals in the city there are sanatoria for consumptive patients at Delamere Forest and Heswall Hills. The Royal Southern Hospital has special arrangements for patients suffering from tropical diseases.

Railways.— Nearly all the English railway companies are connected with Liverpool. The London and North Western, the Lancashire and Yorkshire and the Midland Railway companies have large and commodious passenger stations. In 1895 a new riverside railway station was opened for the convenience of ocean travelers. There are 100 stations in the Liverpool area. The city is also connected by canals with the manufacturing towns of Lancashire, Yorkshire and the Midlands. Within recent years the Mersey Railway, which connects Liverpool with Birkenhead by a tunnel under the river, and the Lancashire and Yorkshire line to Southport were electrified, and the latter was connected at Seaforth with the Overhead Electric Railway which runs along the line of docks from The Dingle.

Trade and Shipping.— Liverpool has a few manufactures, but it is essentially a port. So far as the export trade is concerned statistics prove that it is the leading port in the United Kingdom, while for imports it is second only to London. It is the natural outlet for the great manufacturing industries of Lancashire, and most of the raw cotton is imported here. The total value of exports to the United States in 1917 was $24,065,832 compared with $30,144,189 in 1916, a decrease due to the war of over $6-000,000 chiefly in Egyptian cotton. Shipments of manufactured goods, however, increased from $8,200,834 in 1916 to $10,444,820 in 1917, a gain of $2,243,986. Not the least important part of the shipping industry is the ocean passenger traffic. Connected with the port of Liverpool are fleets of the largest ships afloat, and the daily sailings and arrivals of these steamers to and from all the great ports in the world draw to the city large numbers of emigrants and other passengers. The tonnage of arrivals and departures, including Birkenhead, but excluding coastwise shipping, was in 1914 22,771,000 tons.

Docks.— The first wet dock dates from 1715, when an area of four acres was enclosed. The Mersey Docks and Harbor Board, which was constituted by act of Parliament in 1858, has control of the systems of Liverpool, Birkenhead and Bootle. There are 65 wet docks, which, from Gladstone Dock at the north end to the Herculaneum Dock at the south end, occupy a river frontage of over seven miles, with a water area of 450 acres, and quayage extending for 27 miles. Herculaneum Dock has a fine petroleum reservoir cut out in solid rock, with a holding capacity of 60,000 gallons. The Birkenhead Docks on the south side of the river have a water area of 172 acres and a quay length of 10 miles. The warehouses of the port, particularly those devoted to the storage of grain and tobacco, are of gigantic dimensions, and fitted with every modern appliance. The great passenger steamers nearly all embark and discharge their passengers at the landing stage, which is one of the attractions of the city.

Landing Stage.— It is a floating structure 2,478 feet in length with a general width of about 80 feet. The northern portion of this stage is allotted to the use of the ocean going and coasting steamers, while the southern portion is reserved for the busy ferry traffic across the river to the Cheshire coast..

River Dredging.— One of the most important duties of the Mersey Dock Board is the dredging of the river and increasing the depth of water at the bar which is 11 miles from the landing stage. By the end of the year 1909 nearly 42,000,000 tons of sand had been removed from the bar. The revetment of certain sandbanks has also been undertaken, with 100,000 tons of stone to protect the under stone from erosion. Before dredging was commenced the depth of water at low water of spring tides was 11 feet, whilst now under the same conditions there is a depth of 30 feet.

Such are the efforts necessary to maintain the city in that position so eloquently described by James R. Lowell in the words which appropriately close this notice: «Liverpool is one end of the three thousand mile loom on which the shuttles which are binding us all in visible ties more and more together are continually shooting to and fro.»

History.— The history of Liverpool practically dates from the issue of the letter patent, or charter, by King John in 1207, and the erection of a castle. This latter structure has long since disappeared, part of its site being now occupied by a statue of Queen Victoria. In 1709 a wet dock was constructed, the first in the kingdom. From this event dated the rapid extension of its commerce and population. In 1880 Liverpool was made the see of a bishop, and in that year a charter was granted constituting it a city. The town developed very slowly until after the civil wars, in which it played a prominent part, being besieged three times. The facts stated in this article will prove that Liverpool is in every sense of the word a modern city, its development during the 19th century being almost unparalleled.

Liverpool is justly proud of the distinguished men and women who have been either born within its boundaries or associated with it. There are statues of William Roscoe, William Ewart Gladstone, William Rathbone and others, while the birthplaces of Mrs. Hemans, Arthur Hugh Clough and W. E. Gladstone have had memorial tablets placed on them. The house at Rock Ferry, wherein Nathaniel Hawthorne resided, is well known.

Bibliography.— Baines, 'History of the Commerce and Town of Liverpool' (1852); Ellison, 'The Cotton Trade of Great Britain, with a History of the Liverpool Cotton Market' (1886); Morton, 'The Geology of the Country Around Liverpool' (1891); Picton, 'Memorials of Liverpool, Including a History of the Dock Estate' (2 vols., revised ed., 1903); Muir and Platt, 'History of Municipal Government in Liverpool to 1835' (1906); Muir, 'Municipal History of Liverpool' (1907); 'Victoria History of Lancashire' (Vols. II and IV, 1908); Young, H. S. and H. E., 'Bygone Liverpool' (1918); 'Handbook for the City of Liverpool.'

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LIVERPOOL, Nova Scotia, Canada, the capital of Queen's County, a town and port of entry on the south bank of the Mersey estuary at its entrance into Liverpool Harbor, 80 miles southwest of Halifax. Founded by settlers from Connecticut in 1760, and at one time a centre for privateers, and possessing later an important shipping trade, it has large fisheries and some manufactures of lumber and machinery, grist, pulp, paper and saw mills. Pop. 2,109.

LIVERSIDGE, lĭv'ėr-sĭdj', **Archibald,** Australian chemist and mineralogist: b. Turnham Green, England, 17 Nov. 1847. He was educated at the Royal School of Mines and the Royal College of Chemistry and at Christ's College, Cambridge. In 1867 he was appointed acting instructor of chemistry in the Royal School of Naval Architecture; in 1870 became university demonstrator in chemistry at Cambridge; and since 1874 has been professor of chemistry, from 1883–1904 dean of the faculty of science, and from 1870–1904 Fellow of the senate in the University of Sydney, New South Wales, Australia. He retired in 1909. He also founded the Australasian Association for the Advancement of Science. He has written 'The Minerals of New South Wales'; 'Reports upon Technical Education and Museums,' etc. For many years he edited the *Journal* of the Royal Society of New South Wales.

LIVERWORTS, or **HEPATICÆ,** a group of cryptogamous plants, forming one of the two divisions of the class *Bryophyta* or *Muscineæ* (moss-worts), and closely related to the true mosses (*Musci*), with which some of the species are apt to be confounded. They are either spread out in the form of a simple lobed thallus, showing differentiation into a dorsal (upper) and a ventral (lower) surface, or they are composed of a small ramified stem bearing sessile leaves in two or three ranks. Root-like bodies (rhizoids) attach the plant to its substratum.

Many liverworts reproduce themselves by means of brood-cells (thallidia or gemmæ), formed asexually in cups on the surface, in leaf-margins, etc. They are also reproduced sexually by means of club-shaped antheridia, containing the male elements (antherozoids), and flask-shaped archegonia, containing each an egg-cell or oösphere. These sexual organs occur in groups either in small depressions or special outgrowths of the thallus, or as so-called flowers at the tips of the leafy shoots, or in the axils of their leaves. The spore-capsule is formed after fertilization within the archegonium, and the spores are often provided with hygroscopic elaters which assist in their dispersal. On germination a spore produces, not the common liverwort plant, but a very small filamentous protonema. There are four families of liverworts, namely, *Ricciaceæ, Marchantiaceæ, Anthocerotaceæ* and *Jungermanniaceæ*. The first includes the duck-weed-like crystalwort (*Riccia natans*); the second the exceedingly common *Marchantia polymorphia*, formerly used as a basis for medicine for ailments of the liver (whence the name “liverwort”); and the last, which is much the largest family, comprises all the leafy, as well as some thalloid forms. The Hepaticæ are generally distributed over the world, and prefer situations similar to those occupied by the mosses. There are about 4,000 species, of which about 3,500 belong to the *Jungermanniaceæ*. See authorities on cryptogamic botany, especially Cooke's ‘British Hepaticæ’ (1893); and Strasburger, ‘Text-book of Botany’ (1903).

LIVES, Parallel (*βιοι παράλληλοι*), the work upon which Plutarch's fame chiefly rests, were published by him late in life after his return to Chæronea, and, if one may judge from the long lists of authorities given, must have taken many years in the compilation. The biographies appear in pairs, each of which places a Greek and Roman in juxtaposition. For example, Theseus and Romulus are compared as the legendary founders of states. Twenty-two pairs are extant: Theseus and Romulus, Lycurgus and Numa, Solon and Valerius Publicola, Themistocles and Camillus, Pericles and Fabius Maximus, Alcibiades and Coriolanus, Timoleon and Æmilius Paulus, Pelopidas and Marcellus, Aristides and Cato the Elder, Philopœmen and Flaminius, Pyrrhus and Caius Marius, Lysander and Sulla, Cimon and Lucullus, Nicias and Crassus, Sertorius and Eumenes, Agesilaus and Pompey, Alexander and Julius Cæsar, Phocion and Cato the Younger, Agis and Cleomenes and Tiberius and Caius Gracchus (a double comparison), Demosthenes and Cicero, Demetrius Poliorcetes and Antony, Dion and Brutus. To these are added the four single lives of Aratus, Artaxerxes Memnon, Galba and Otho, making a total of 50 lives. There are traces of perhaps 12 more biographies that are now lost. Eighteen of the 22 pairs close with a sort of balanced judgment (σύγκρισις) of the two careers and characters. These formal comparisons abound in contrasts rather than in resemblances, the latter indeed being sometimes a trifle forced. This need not be wondered at, inasmuch as Plutarch's object was not to write history, but to prove that the more remote past of Greece could show its men of action and achievement as well as the nearer and, therefore, more impressive past of Rome. In these biographies, therefore, the interest is primarily ethical, although they have no mean historical value. In spite of his lack of judicious discrimination in the use of authorities and the consequent errors and inaccuracies, Plutarch gives an abundance of citations and incidentally a large number of valuable bits of information which fill up numerous gaps in the historical knowledge obtainable elsewhere. Owing to the liveliness and warmth of portrayal and the moral earnestness and enthusiasm displayed by their author, the ‘Lives’ have not failed to attract a large circle of readers throughout the ages, in spite of a certain degree of uniformity inherent in the very plan of the series. Their wide appeal is instanced by the fact that ‘Julius Cæsar,’ the first of Shakespeare's Roman plays, like those that followed, namely, ‘Coriolanus’ and ‘Antony and Cleopatra,’ was based on Plutarch's ‘Lives’ as translated from the French translation of Jacques Amyot (1559) and published by Sir Thomas North in 1579. ‘Timon of Athens’ likewise is based, at least in part, upon Plutarch's life of Mark Antony. The chief manuscripts of the ‘Lives’ date from the 10th and 11th centuries; the first edition appeared at Florence in 1517. The most generally accepted text is that of the minor edition of Carl Sintenis in the ‘Bibliotheca Teubneriana’ (5 vols., Leipzig 1852–55; reissued without much change in 1873–75). There are annotated editions by I. C. Held, E. H. G. Leopold, Otto Siefert and Friedrich Blass and Carl Sintenis, all in German; and by Holden, in English. Besides North's translation (mentioned above), there are English translations by John and William Langhorne (1770), by Dryden and others (1683), and, of the Roman lives, by George Long. A. H. Clough's revision of the so-called Dryden edition was published in five volumes in 1859 and reprinted in one large octavo volume in 1876 and 1880. Finally, mention must be made of Bernadotte Perrin's translation, with the Greek and English texts *en regard*, in the ‘Loeb Classical Library,’ in 10 volumes, five of which have already appeared.

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LIVES OF THE POETS. The ‘Lives of the Poets,’ the “most memorable of Johnson's literary works,” is an established English classic. It is so ranked in spite of inequalities and numerous defects resulting from Johnson's predilections and methods of work. Early in 1777, to meet the competition of the Martins, Edinburgh publishers, the leading booksellers of London were under the necessity of bringing out an edition of the English poets. Johnson was selected to write what he himself called “little lives and little prefaces” to such “a little edition.” It was at first the intention to begin with Chaucer. That the collection did not begin with Chaucer, that it included such inferior poets as Broome, Duke, Granville, Hughes, Sheffield, Edmund Smith and Stepney, while Carew, Crashaw, Herbert, Herrick, Lovelace, Marvell and Vaughan were omitted, is doubtless due to the fact that Johnson did not care to undertake the task of treating periods for which he had no particular liking and with which he was not thoroughly familiar. So far as possible he confined himself to the poets of the classical school. Forty-eight of the 52 poets were named by the booksellers; Blackmore, Watts, Pomfret and Yalden were added upon the request of Johnson. There is little doubt that the booksellers would have been glad to follow any suggestions that Johnson cared to make. The «little» work originally contemplated steadily grew. «My purpose,» he wrote, «was only to have allotted to every poet an advertisement . . . containing a few dates, and a general character; but I have been led beyond my intention, I hope by the honest desire of giving useful pleasure.» The 'Lives' were written at intervals between July 1777 and March 1781.

Johnson did not follow modern methods of research; he wrote from a full mind, took what easily came to hand and gave little thought to what he could not find. Of mere details, he was impatient: «To adjust the minute events of literary history,» he asserted in the life of Dryden, «is tedious and troublesome: it requires indeed no great force of understanding, but often depends upon inquiries which there is no opportunity of making, or is to be fetched from books and pamphlets not always at hand.» Not all of the narratives were written for the purpose in hand, nor were all, the result of Johnson's own labors. The 'Life of Savage' had been published in 1744. The 'Life of Edward Young' was written at Johnson's request by Herbert Croft. The 'Life of Butler' was derived from a comparison of accounts given by an unknown writer of doubtful authority, and by Anthony Wood. The 'Life of Parnell' is an abstract from the narrative by Goldsmith. Of Edmund Smith, Johnson says: «I shall subjoin such little memorials as accident has enabled me to collect.» He confessed at the close that he had written «dilatorily and hastily, unwilling to work, and working with vigor and haste.» His standards of criticism, those of the classical school, prevented him from doing full justice to such poets as Milton, Collins and Gray. Against the defects of work so produced, the general reader should be warned. «With its slips and errors uncorrected,» says J. Churton Collins, «and read without guidance, no unfitter book could be placed in any reader's hands; properly edited, and with a proper commentary, no book more serviceable.»

What, then, is the value of such a work? It is manifold. For one thing, Johnson killed forever the merely panegyric type of biography. «We have had enough honeysuckle lives of Milton,» he said; «mine shall be in a different strain.» In none of the narratives is he merely a praiser or a fault-finder; he strikes a sane balance. The greatest value of the whole lies not alone in the facts, although students must always reckon with Johnson for certain facts, many of which, but for him, might have been lost. It does not depend upon the mere methods of biography, which in many respects might have been improved. Its greatest value arises from the fact that we are therein given the last judgments of a great literary dictator. The 'Lives of the Poets' is the product of Johnson's privileged old age. He had read much, experienced much, thought much. We are enabled to listen to the mature mind of one great literary man delivering itself in regard to other literary men, small as well as great. The 'Lives' are thus invaluable as documents of that school of classical criticism so well represented by Johnson. They are equally invaluable for the element of philosophical comment which runs throughout. «His work closes an age; it is the Temple of Immortality of the great Augustans, and, when it was published, already Burns and Blake, Crabbe and Cowper, were beginning to write.»

Two of the best critical articles are J. Churton Collins' «Dr. Johnson's 'Lives of the Poets'» (in *Quarterly Review*, Vol. CCVIII, pp. 72–97); and Chapter 6 of Prof. Walter Raleigh's 'Six Essays on Johnson.'

WALDO H. DUNN.

LIVIA DRUSILLA, lĭ'vĭ-ạ drō-sĭl'lạ, wife of the Roman Emperor Augustus: b. about 55 B.C.; d. 29 A.D. She was the daughter of L. Livius Drusus Claudianus, who committed suicide after the battle of Philippi. Livia became the wife of Tiberius Claudius Nero, by whom she had two sons, Tiberius the future emperor, and Drusus. While still pregnant with the latter she was married to Octavianus (Augustus), who had been captivated by her beauty and her talent, and who to bring about this union had divorced Scribonia, and forced Tiberius Nero to divorce Livia. The union with Augustus seems to have been a happy one, but there is a suspicion that Livia's ambition to secure the succession for her own sons caused her to commit many crimes in order to remove the members of the family of Augustus, to whom the succession would naturally have fallen. Thus the death of Marcellus, nephew of Augustus, and of Lucius and Gaius Cæsar, sons of Agrippa, was charged to her machinations, nor was she free from the suspicion of having hastened the end of Augustus himself. Meantime her surviving son, Tiberius, had been adopted by Augustus, who designated Livia and Tiberius as his principal heirs. On her son's succession to the imperial dignity Livia continued for a long time to exercise great influence, so much so that at first it seems to have been felt that Tiberius was subservient to her will; but in fact Tiberius, while considerate of his mother, always maintained an attitude of independence toward her in all affairs of state, and thus by degrees a spirit of alienation grew up between them which increased so much with years that Tiberius refused to visit her on her death-bed, or even to execute the directions of her will. She died at an advanced age. Consult Tübker, Frederich, 'Reallexikon des klassischen Altertums' (Vol. II, 8th ed., Leipzig 1914).

LIVING MAMMALS, Distribution of. See DISTRIBUTION OF LIVING MAMMALS.

LIVINGSTON, Burton Edward, American plant physiologist: b. Grand Rapids, Mich., 9 Feb. 1875. In 1898 he was graduated at the University of Michigan and in 1902 obtained the degree of D.Ph. at the University of Chicago. In 1895–98 he was assistant in plant physiology at the University of Michigan and from 1899 to 1905 was Fellow and assistant in plant physiology at the University of Chicago. He served as soil expert of the United States Bureau of

Soils and had charge of fertility investigations in 1905–06. From 1906 to 1909 Mr. Livingston was staff member of the department of botanical research of the Carnegie Institution, Washington, D. C. In the latter year he was appointed professor of plant physiology at Johns Hopkins, where since 1913 he has also served as director of the laboratory of plant physiology. He has published ‘Rôle of Diffusion and Osmotic Pressure in Plants’ (1903) and numerous scientific papers. He translated and edited Palladin's ‘Plant Physiology’ (1918). Professor Livingston has invented a porous cup atmometer for measuring evaporation as a climatic factor and of an auto-irrigator for automatic control of soil moisture in potted plants.

LIVINGSTON, Edward, American statesman: b. Clermont, N. Y., 26 May 1764; d. Rhinebeck, N. Y., 23 May 1836. He was graduated from the College of New Jersey in 1781, was admitted to the bar in 1785, was a New York representative in Congress (1795–1801) and was a leader of the opposition. In 1801 he was appointed by President Jefferson United States attorney for the New York district, and in that year became also mayor of New York. During the yellow fever epidemic in 1803 he was stricken with the disease, and during his illness $43,666, for which he was responsible to the United States government, were misappropriated by his fiscal agent. He confessed judgment in favor of the United States for $100,000, and resigned both his offices. Every dollar of this amount was subsequently repaid. In 1804 he began the practice of law at New Orleans and, accepting land in lieu of fees, acquired a lucrative practice, and drew up a code of legal procedure. At the time of the preparation for the battle of New Orleans, he was president of the committee of public defense, and Jackson's chief assistant. During the battle he served on Jackson's staff. In 1820 he was elected a representative to the State legislature of Louisiana, in 1822–29 represented the New Orleans district in Congress, and from 7 Dec. 1829 to 3 March 1831 was United States senator from Louisiana. In 1831 he became Secretary of State in Jackson's Cabinet. This post he resigned to become Minister to France in 1833; and in 1835 he returned to the United States. He was a distinguished lawyer; and as Secretary of State exercised strong influence on the administration of Jackson, whose state papers, including the Nullification proclamation of 10 Dec. 1832, are generally believed to have been written by him. The most remarkable of his legal works is his ‘System of Penal Law for the State of Louisiana,’ which, written between 1821 and 1824, was accidentally destroyed by fire, was rewritten and published in 1826, and earned for its author from Sir Henry Maine the description of «the first legal genius of modern times.» He also wrote ‘System of Penal Law for the United States’ (1828). His ‘Complete Works on Criminal Jurisprudence’ appeared in 1873. Consult the biographies by C. H. Hunt (New York 1864); and Carleton Hunt (New Orleans 1903).

LIVINGSTON, Henry Brockholst, American jurist: b. New York, 26 Nov. 1757; d. Washington, D. C., 19 March 1823. He was a son of William Livingston (q.v.), and graduated from the College of New Jersey in 1774, was commissioned a captain in the Continental army and later became aide to Gen. Philip Schuyler in the northern department with rank of major. He was also aide to Gen. Arthur St. Clair, took part in the siege of Ticonderoga and was present at Saratoga. Subsequently he was again with Schuyler and was promoted lieutenant-colonel. In 1779 he went to Spain as private secretary to John Jay, in 1782 on the return voyage was captured by the British, and was for a time imprisoned at New York. In 1783 he was admitted to the bar and entered practice in New York. He was judge of the New York Supreme Court in 1802–07, and from 1807 was associate justice of the United States Supreme Court until his death. On the organization of the New York Historical Society in 1805 he became its second vice-president. He was popularly known as Brockholst Livingston.

LIVINGSTON, John H., American divine and virtual founder of two institutions of learning, Rutgers College and the Theological Seminary of the Reformed Church in America, at New Brunswick, N. J.: b. Poughkeepsie, N. Y., 30 May 1746; d. 20 Jan. 1825. He was graduated from Yale College and studied law two years, but in New York came under the influence of Archibald Laidlie (Flushing) and chose the ministry. He sailed for Europe, 12 May 1766, being the last of American youth in the then Dutch Reformed Church to study theology in Holland. At Utrecht University, he sought and won, by discussion in the Latin language, the degree of doctor of divinity and wrote a Latin thesis. Called to the Collegiate Reformed Church in New York City, he acted as a peacemaker between the parties in the denomination formed chiefly on the idea of speedy, or of slow Americanization and use of the English language. Largely under his personal influence, Rutgers College (chartered in 1766) and the Theological Seminary, the second oldest in America, were begun. In the Revolution, his Americanism was so ardent during the British occupation that he had to leave the city. To the Utrecht University motto, of 1648, after the end of the Netherlands '80 years' war for freedom, «Sol-justitiæ illustra,» Livingston added for Rutgers College «et occidentem»—«[Divine] Sun of righteousness illuminate also the West.» Probably no institution of learning, with the Atlantic between, has a closer historical connection with Europe than Rutgers College with Utrecht University. On 9 July 1909, the friends of Rutgers College unveiled in the aula of the University of Utrecht a bronze tablet to the memory of Livingston with the inscription in Latin, meaning «We salute Utrecht University as the dear mother of our dear mother.» Livingston's voluminous writings include the first hymnbook (in English) and the constitution of the Reformed Church in America. Consult Gunn, ‘Memoirs of Dr. Livingston’ (1836).

LIVINGSTON, Peter van Brugh, American merchant: b. Albany, N. Y., October 1710; d. Elizabethtown, N. J., 28 Dec. 1792. He was graduated from Yale in 1731, at New York was active in the shipping business with William Alexander, Lord Stirling, and in 1755 provided the supplies for Governor Shirley's expedition to Acadia. He was long a member of the provincial council, and in 1775–76 was a delegate to the 1st and 2d provincial congresses of New York, of the former of which he was president. In 1776–78 he was treasurer of the congress. He was prominent in most of the measures that led up to the Revolutionary War, notably as a Mohawk of the «Nancy Tea Party» in New York City in 1774, and was referred to by John Adams as «staunch in the cause.» As a Presbyterian he was also one of the founders of the College of New Jersey, which later became Princeton College.

LIVINGSTON, Philip, American patriot: b. Albany, N. Y., 15 Jan. 1716; d. York, Pa., 12 June 1778. He was graduated from Yale in 1737, became a prosperous merchant in New York, in 1758–69 was a member of the Colonial assembly, of which he was speaker in 1768, but was unseated by the Tory majority because of his strong Whig views. In 1774–78 he represented New York in the Continental Congress, and in 1776 signed the Declaration of Independence. Subsequently he sat in the New York provincial congress, in the State assembly and in the senate. His legislative services were many. He was also a benefactor of King's (later Columbia) College, of Yale College, and was one of the founders of the New York Chamber of Commerce.

LIVINGSTON, Robert, American colonial-proprietor: b. Ancrum, Scotland, 13 Dec. 1654; d. Albany, N. Y., 20 April 1725. He emigrated to America in 1673, spent a part of a year at Charlestown, Massachusetts Bay, removed to Albany, N. Y., and was there in 1675–86 secretary of the commission who directed the affairs of Albany, Schenectady and the region adjacent. In 1686–1721 he held the corresponding office of town clerk. In 1686 he received from Gov. Thomas Dongan the grant of a large tract, which comprised extensive portions of the present counties of Dutchess and Columbia, and which was confirmed by royal charter of George I in 1715. This tract was erected into the lordship and manor of Livingston, and as Livingston Manor has since been known. Livingston was the first to obtain the means for the equipment of the expedition of Capt. William Kidd (q.v.) against the pirates. He was elected member of the assembly for Albany in 1711, and sat for his manor in 1716–25. From 1718 he was speaker. Consult 'The Livingstons of Livingston Manor' (New York 1910).

LIVINGSTON, Robert R. (the initial R. having been assumed for purposes of distinction), American statesman, commonly known as «Chancellor Livingston»: b. New York, 27 Nov. 1746; d. Clermont, N. Y., 26 Feb. 1813. He was graduated from Columbia (then King's College) in 1765, was admitted to the bar in 1773, was for a brief period partner in legal practice with John Jay, in 1773–75 was recorder of New York city, lost this post through his revolutionary spirit, and in April 1775 was elected from Dutchess county to the New York State assembly. In 1776 he was sent by the assembly to the Continental Congress, where he was one of the committee of five appointed to draft the Declaration of Independence, which, however, he did not sign owing to his return to enter the provincial convention. He took his seat on 8 July 1776, and was of the committee to draw up a State constitution. Under this instrument he became the first chancellor of New York (1777–1801). He resigned from the Continental Congress in 1777, but was again one of its members in 1779–81. He was secretary for foreign affairs of the United States Confederation in 1781–83, in which post he conducted with much success the business previously entrusted to the committee of secret correspondence. As chancellor he administered the oath of office to George Washington on the latter's inauguration as first President of the United States (30 April 1789). In 1801–05 he was Minister to France, in which capacity he, with James Monroe as additional plenipotentiary, concluded the treaty by which Louisiana was ceded to the United States for the sum of $15,000,000. He became the partner of Robert Fulton (q.v.) in experiments toward the employment of steam-power in navigation; launched a boat on the Seine, but was not fully successful; and later continued the work with Fulton in the United States; where in September 1807 the *Clermont* made the trial trip from New York to Albany in 22 hours, the average rate of speed thus being five miles per hour. Livingston also introduced merino sheep into New York, made general the use of gypsum for fertilizing purposes, was the principal founder (1801) of the New York Academy of Fine Arts and its first president, and was also for a time president of the New York Society for the Promotion of Useful Arts. He was styled by Franklin the «Cicero of America.» By act of Congress his statue was placed in the Capitol at Washington, as one of the two representative citizens of New York State, George Clinton being the other. He published 'Essays on Agriculture,' an 'Essay on Sheep' (1809), and some addresses. Consult the biographical sketch by De Peyster (New York 1876); Delafield, 'Robert R. Livingston of New York and his Family' (Albany 1911); and E. B. Livingston, 'The Livingstons of Livingston Manor' (New York 1910).

LIVINGSTON, William, American statesman: b. Albany, N. Y., 30 Nov. 1723; d. Elizabethtown, N. J., 25 July 1790. He was graduated from Yale in 1741, was admitted to the bar in 1748, attained distinction in practice, was elected to the provincial legislature from Livingston manor, and in 1760 established himself at the well-known country-seat of «Liberty Hall» at Elizabethtown, N. J. In 1774 he became a delegate for New Jersey province to the First Continental Congress, and later served in the second and third congresses. He was a member of the committee of the first congress that prepared the address to the people of Great Britain. It was with great reluctance that he set himself in opposition to the mother country; but the step having been taken, he supported the Revolution with all his powers. In June 1776 he took command of the militia of New Jersey, with rank of brigadier-general, and was thereby prevented from signing the Declaration of Independence. On 28 Aug. 1776 he was elected first governor of New Jersey, and this post, having resigned his military command, he held until his death. During the first two years of his administration the State of New Jersey was perhaps more than any other exposed to the operations of the British forces, and this was the cause of many difficulties and dangers. The legislature was compelled to meet at various different places, and Tory hostility was strong against the governor, whose capture was several times attempted. In his message of 1777 to the assembly, Livingston recommended the abolition of slavery, and in 1786 caused the passage of an act forbidding the importation of slaves into New Jersey and himself liberated his two slaves. In 1787 he was appointed a delegate to the convention that framed the Constitution of the United States. He was at one time president of the «Moot,» the well-known lawyers' club founded at New York in 1770. He published in 1752 52 numbers of *The Independent Reflector,* a weekly periodical, in which he opposed the Episcopal Church. His writings include ‘Philosophic Solitude’ (1747); ‘A Funeral Eulogium on the Rev. Aaron Burr’ (1757); and ‘A Digest of the Laws of New York, 1691–1762’ (with W. Smith, Jr., 1752–62). Consult Sedgwick, ‘Life and Letters of William Livingston’ (1833).

LIVINGSTON, Guatemala, seaport situated on the Gulf of Amatique, at the embouchure of the Dolce. It is an important trade mart as the port of Izabal, with which it has boat connections on the Dolce. Cabinet woods, coffee and bananas are the chief items of its export trade, which is mostly with the United States. A consular agent of the United States maintains an office here. Pop. 2,000.

LIVINGSTON, Mont., city, county-seat of Park County, on the Yellowstone River, and on the Northern Pacific Railroad, about 45 miles north of the Yellowstone National Park, and 100 miles southeast of Butte. It is situated in a mining and lumbering section of the State. A branch of the Northern Pacific Railroad extends from Livingston to the Yellowstone park. It is the division headquarters for the Northern Pacific. Its chief manufacturing establishments are machine shops, lime works, railroad shops and lumber mills. Its trade is mainly in mining tools, wool, coke, coal and gold, and it is a distributing centre for groceries, dry goods and clothing for an extensive region. Livingston is a favorite resort for sportsmen, as game and fish abound. Pop. 5,359.

LIVINGSTON MANOR, at one time a large tract of land in New York State, on the east side of the Hudson River, and the northern part of what is now Dutchess County. This land was obtained by Robert Livingston, in 1674, and comprised about 160,240 acres. The title was confirmed in 1715, and the patent obtained gave the land to the heirs forever. In 1752–54 Governor Clinton of New York had to settle a dispute as to the eastern boundary; Massachusetts and the Livingstons both claiming the same land. The manor was divided and subdivided into holdings which were let to tenants. In 1795 the tenants made an effort to have the title pronounced invalid, but it was decreed that the land was Livingston property. In 1844 the tenants again sought to get possession, and they petitioned the legislature to set aside the grant, but the petition was not granted. Since that time the owners have sold to individuals the larger part of the old Livingston Manor. Consult Vol. III of ‘Documentary History of New York State’ (Albany 1850).

LIVINGSTONE, lĭv'ĭng-stŏn, **David,** Scottish missionary and African traveler: b. Blantyre, Lanarkshire, 19 March 1813; d. near Lake Bangweolo, Africa, 1 May 1873. His parents had settled in the neighborhood of the cotton mills near Blantyre, where David became a «piecer» at the age of 10. While at work in the mill he learned Latin and read extensively, and having attended the medical and Greek classes at Glasgow University during the winter months finally became a licentiate of the Faculty of Physicians and Surgeons of Glasgow. Under the direction of the London Missionary Society he proceeded in 1840 to South Africa, where he joined Robert Moffat in the missionary field. His first station was in the Bechuana territory, and here his labors for nine years were associated with Mr. Moffat, whose daughter he married. Hearing from the natives that there was a large lake north of the Kalahari Desert, he proceeded to explore that region, and discovered the valley of the Zouga and Lake Ngami. Subsequently he penetrated farther northwest until he reached Linyanti, the capital of the Makololo territory, situated on the Chobe, a tributary of the Zambesi, which river he also visited. In 1853–56 he made a great exploratory journey, or series of journeys. Starting from Linyanti he ascended the Leeambye (Upper Zambesi), journeyed overland to Lake Dilolo, and thence to Saint Paul de Loanda on the west coast. Returning to Linyanti, he went eastward from there in 1855, tracing the Zambesi to the Indian Ocean, and reaching Quilimane on the east coast in 1856, having thus crossed the entire continent. The record of this journey is found in his ‘Missionary Travels and Researches in South Africa’ (1857). He severed his connection with the London Missionary Society in 1858 and was appointed British consul at Quilimane. From that year until 1864 he with Sir John Kirk explored the Zambesi, Shire and Roouwa rivers and discovered Lake Nyasa, the literary result of which was ‘The Zambesi and its Tributaries’ (1885). Livingstone set forth in 1865 to set at rest the question of the sources of the Nile. From this time till his death he was engaged in laborious explorations in the lake region of South Africa, especially to the westward of Nyassa and Tanganyika, where he discovered Lakes Bangweolo and Moero, the Upper Kongo, etc. For about three years no communication had come from him, and the doubts regarding the traveler's safety were only set at rest when it was known that H. M. Stanley, the special correspondent of the New York *Herald,* had seen and assisted Livingstone at Ujiji, on Lake Tanganyika. They parted in March 1872, Livingstone going to explore the southern end of Tanganyika and Stanley proceeding to Zanzibar. After another year's wanderings he was attacked with dysentery near Lake Bangweolo, and there he died. His body was buried in Westminster Abbey, having been conveyed to the coast, rudely preserved in salt, by his faithful followers. Consult ‘Livingstone's Last Journals’ (1874); Stanley, ‘How I Found Livingstone’ (1873); Blaikie, ‘Livingstone's Personal Life’ (1880); Hughes, ‘David Livingstone’ (1891); Johnston, ‘Livingstone and the

Exploration of Central Africa' (1897); Maclachlan, 'David Livingstone' (1900); Stanley's 'Autobiography' (1911) and 'How I Found Livingstone' (1913), and Horne, 'David Livingstone' (1913).

LIVINGSTONIA MISSION, British Nyassaland Protectorate, central Africa, founded in 1875 by Stewart of Lovedale for the Free Church of Scotland (now the United Free Church). The first settlement was made at Cape Maclear at the southern end of Lake Nyassa, but the chief settlement is at Bandawè, on the west shore of the lake. The establishment of the mission was the result of a suggestion made by Livingstone (q.v.) that the shore of this lake was a good position for a mission that might counteract the slave trade which was carried on by the Arabs and Portuguese. The Church of Scotland established a mission at Blantyre, in the Shiré Highlands, near the lake — a mission which it is anticipated may soon be united with the Livingstonia Mission. At Blantyre some manufacturing establishments have been established, a foundry, basket factory, cloth mill (the cloth is made from the bark of trees) and a cotton factory. The Portuguese, in 1889, tried to get possession, but since 1890 the British have had control.

LIVIUS ANDRONICUS, the founder of Roman epic poetry and drama, by birth a Greek of Tarentum. He first went to Rome at the commencement of the 3d century B.C. as instructor to the children of Livius Salinator. He introduced upon the Roman stage dramas after the Grecian model and wrote a translation of the 'Odyssey' in the old Saturnine verse. His fame, however, rests chiefly upon his hymn written in celebration of the battle of the Metaurus River. Consult Duff, J. W., 'A Literary History of Rome' (New York 1909).

LIVNY, lyĕv'nĭ, Russia, capital of the district of the same name, situated in the government of Orel, on the Sosna River, 95 miles southeast of the city of Orel. It contains a bank, a gymnasium or high school and two libraries. Its industries include manufactures of flour, leather, soap, tallow and tobacco. There is also a large trade in grain. The city dates from 1586. Pop. 23,700.

LIVONIA, lĭ-vō'nĭ-ą (Ger. Livland; Russ. Livlandya), a former government of Russia and one of the three Baltic provinces, bounded on the north by Esthonia, south by Courland, on the west by the Gulf of Riga and east by Lake Peipus and the governments of Petrograd, Pskov and Vitebsk. Together with Oesel, Mohn, Paternoster and some smaller islands in the Gulf of Riga the total area is about 17,500 square miles, with a population of 1,740,000 in 1914. Riga, the capital, is the most German town outside Germany and has a population of 560,000. Consisting mainly of marsh and low sand, the territory has little fertility and few forests. Over 18 per cent of the area is meadow land, over which great herds of cattle are spread, particularly horses. There is an abundance of inland waterways, though only the Dvina, the Pernau and the Aa near the Embach are of any importance for communication. The Salis and the Pernau are only partially navigable, owing to rapids, narrowness and shallow bottom. The one trunk line of railway runs from Riga through Dorpat and Taps to Petrograd. Little wheat is grown in Livonia; rye, potatoes and oats are standard crops; dairy farming, though extensively carried on, yields but little profit. Altogether the country is in a backward and neglected condition. Some 400 factories were in operation before the war; Riga was the centre of the Russian flax and timber trade, also of rubber and textiles, foundries, pulp-mills and china manufacture. In 1915 the Russians started scrapping and dismantling all the machinery to prevent it from falling into German hands, leaving Riga little more than an empty shell.

The population of Livonia is predominantly Russian; about 8 or 10 per cent is German; the aborigines are of Finnish origin and are more closely allied to the Slavs than the Germans. Letts, Esthonians, Swedes, Poles and Jews make up the remainder of the inhabitants. The Esthonians occupy the north and east portion of Livonia; the Letts the south and west. Most of the people are Protestants of the Augsburg Confession.

During the 12th and 13th centuries the Lett tribes of the Baltic were considered by the Russian princes and republics of the northwest as their subjects or tributaries. Danes conquered Esthonia, and Yaroslav the Great founded Yuriev (Dorpat). With the German Hanseatic merchants Latin missionaries appeared on the Baltic. The archbishop of Bremen sent the monk Meinhard to convert the Livonians. In 1187 the latter built a church at Uexküll and a fortress round the church. From this day the tribes lost their lands and their liberty. The Livonians rose in revolt in 1198 and Meinhard's successor, the second bishop of Livonia, was killed in battle. The natives returned to their heathen gods and plunged into the Dvina "to wash off the baptism they had received, and to send it back to Germany" (Rambaud). Pope Innocent III (reigned 1198–1216) preached a crusade against the Livonians and another bishop was appointed over the natives. He arrived with a fleet of 23 ships, built the town of Riga and made it his capital in 1200. This ecclesiastic, Albert of Buxhœvden, founded the German rule in Livonia. The natives implored the help of the princes of Polotsk and marched on Riga, where they were defeated in 1206. The Prince of Polotsk besieged the town during the bishop's absence, but it was saved by the arrival of a German flotilla. In 1410 the power of the Teutonic Knights was broken by the Poles under the Lithuanian kings. The expansion of Muscovy (Russia) turned the Tsar's desires toward the Baltic; between them and the goal, however, lay Sweden, the Livonian Knights, Lithuania and Poland. War broke out in 1554 under Ivan the Terrible and Gustav Vasa of Sweden. Four years later the Russians conquered a considerable part of Livonia. The Poles come to the rescue, and by 1562 they had gained control over the Baltic provinces. Gustav Adolph of Sweden captured Riga in 1621, and Sweden enjoyed the supremacy of the Baltic for nearly a century. The war between Peter the Great assisted by Prussia and Charles XII resulted in the defeat of Sweden in 1709, and in 1721 Russia finally received Livonia, Esthonia, Ingria, Carelia and part of Finland. For 196 years Livonia remained part of the Russian Empire, until it was overrun by the Germans in 1917, and Riga fell on 3 September. That event led the Kaiser to declare that the Germanization of the Baltic lands was "now made secure for all time." Under the terms of the Brest-Litovsk peace treaty, signed by the Bolshevist leaders on 3 March 1918, Russia agreed to abandon territories amounting to nearly a quarter of the total area of European Russia, in which Livonia, Esthonia and Courland were included. Under the terms of the armistice, dictated by the Allies to Germany on 11 Nov. 1918, all German troops were to be withdrawn from territories which had before the war belonged to Russia, as soon as the Allies should decide. On 15 Nov. 1918 it was announced that Livonia, Esthonia and Courland had decided to form a joint Baltic state.

LIVRE, lē-vr', an ancient French coin, now superseded by the franc as the unit of value. The livre was equal to about 20 francs ($4). The livre was also the unit of weight until superseded by the kilogram — the equivalent of two livres — in the metric system.

LIVY (Titus Livius), Roman historian: b. Patavium (Padua), 59 B.C.; d. there, 17 B.C. He spent most of his time at Rome, but kept aloof from active political life, although among his friends were numbered the most eminent men of his day. In spite of his republican leanings he was befriended by Augustus, who counted him, with Virgil and Horace, as one of the literary ornaments of his court. His principal work is the 'History of Rome' in 142 books (*Titi Livii ab Urbe Condita Libri*), which comprehends a period extending from the building of the city to the year 9 B.C. Only 35 of these books are extant, namely, the first 10, which cover the period ending 293 B.C., and the 25 from the 21st to the 45th books, which comprehend the years between 218 and 167 B.C., as well as a number of fragments and short abstracts, or tables of contents of all the books excepting the 136th and the 137th. Livy undertook this work, as he states in his preface, partly that he might plunge his mind into things of the past, and so forget the grievances of the present, and partly that he might spread out before his contemporaries a picture of the nation's ancestral glories. He has indeed produced a work which is truly national, which has always received the admiration and esteem of antiquity and is in modern times regarded as one of the most precious relics of Latin literature. Since his time it has been the source of all knowledge of the period it deals with. He began its composition between the years 27 B.C. and 25 B.C., and published it from time to time in a series of detached parts; the present division into decades is of later origin. It appears that he was engaged upon his history up to the time of his death, but failed to carry it on to the end he had meditated, which would have included the death of Augustus. He had a practical object in view in the accomplishment of this task, but this was less to achieve a critical and scientific exploration of the past than to produce a moving, lifelike and readable representation of the time and country in which he lived. With this end in view he has chosen a style of his own; not the transparent splendor of Cicero, nor the condensed and epigrammatic pungency of Tacitus, nor the dilettante, though sometimes effective, archaism of Sallust. His narrative moves along with stately dignity; it teems with anecdote and glows with patriotic emotion. He employs a phraseology remarkable for copiousness, for picturesqueness, for vivid description and occasionally for an eloquence that is burnished into poetic lustre. His materials must mainly have been derived from preceding annalists, but he weaves into his work the local traditions of a mythic age and rivals Virgil in his love for the fables of Tuscany and Latium. His account of the Punic wars he draws from Polybius. We must not, however, expect to find in his writings a clear account of the origin and development of the Roman constitution. He seems to have cared little for the study of constitutional law, and even less for that of military art. Yet his political views were very decided, and in his account of the civil war, which resulted in the downfall of the republic, he shows himself a strong partisan of the aristocratic party, so that Augustus did not hesitate to style him a Pompeian. The historic basis for the Roman history of Livy cannot be fully understood without reading the works of Niebuhr. Livy's complete works have been published by Gronov (1679); Drakenborch (1828); Zingerle (1883); an English translation appears in the Bohn Library, and a complete German translation by Klaiber and Teuffel appeared (Stuttgart 1854–56). Fügner's 'Lexicon Livianum' (1889), although incomplete, is important in Livian literature. Consult Niemann, 'Etudes sur la Langue et Littérature de Live' (1884); Taine, 'Essai sur Tite Live' (1888); Madvig, 'Emendationes Livianæ' (1877).

LIXIVIATION, lĭk-sĭv'ĭ-ā'shŭn, the process of separating by percolation a soluble from an insoluble substance. "Leaching" is the common English term for this process. Advantage is taken of the different degrees of solubility of the components of the chosen solvent. In metallurgy the process has been used from the earliest times in the extraction of copper and silver ores. Solvents are employed to dissolve the silver, after which the silver is precipitated from the solution. Usually sodium hyposulphite is used as solvent and sodium sulphide as the precipitant. In recent years investigations have resulted in discovering lixiviation processes which may be employed on a commercial scale for ore extraction. See Copper; Silver.

LIZA. By Iván Sergéyevitch Turgénief. There are several translations for the original title of this novel, 'Dvoryánskoye Gnyezdó' —'A Nest of Nobles,' 'A Nobleman's Nest,' 'A House of Gentlefolk.' The title is evidently more or less symbolical, 'The Nest' not referring to the residence of any particular gentleman or nobleman. The action passes mainly in the city home where Liza lives with her worldly-minded mother and her shrewish-tempered great-aunt. The principal character, Lavretsky, occupies only for a brief time a small country-house which had belonged to his father's sister. The preliminary chapters are largely devoted to tracing the heredity of the various actors in the drama and portray selfish men and women of an earlier generation and their environment. When these explanations have been cleared away and one understands the hidden forces of relentless circumstances, the development of the simple yet unexpected complication of the plot is conducted with a masterly knowledge of human nature. The solution of the tragedy of disappointed love is seen to be in exact accordance with the psychology of the persons involved.

Lizavièta Mikhàilovna Kalètina, known as Liza, is the daughter of a government official, stubborn and harsh, who died when she was 10 years of age, leaving a large property in the hands of his widow, Mârya Dmítrievna, a woman fairly well educated, sentimental and amiable when her will was not crossed. During her impressionable childhood Liza was given over to the care of the old nurse, Agâfya Vlásievna, who had occupied an equivocal position in her grandfather's household but on the old man's death had become fanatically devout. Liza's mother made no attempt to offset the influence of those early religious practices. At the beginning of the story Liza is about 20, very pretty, graceful, winning, unselfish and affectionate, «loving everyone in general but no one in particular.» When a distant kinsman of the family, Feòdor Ivánovitch Lavrétsky, returns to Russia after a long residence abroad, she considers it her duty to try to reconcile him with his wife, whom he had repudiated on account of her immoral relations with a Frenchman. Lavrétsky is no longer young; but he is still attractive and Turgènief evidently did his best to depict him as a sympathetic type of the Russian gentleman, in spite of his birth (his mother had been a servant maid, first seduced and then hastily married against his tyrannical grandfather's wishes). Notwithstanding a one-sided and distorted education, Lavrétsky has done his best to remedy the defects in his training and is now ready to take up his duties as benefactor to his serfs and as manager of his large estates. While studying at the university he had married Varvâra Pávlovna Korôbuina, the beautiful daughter of a general who had been disgraced by reason of certain dishonest practices. She was unworthy of him and when he found proofs of her unfaithfulness, he settled a pension on her and left her. He is immediately attracted by Liza, whom her mother wishes to marry to Vladímir Nikolàyevitch Pánshin, a good-looking young official who had been sent to the provincial town of O—— (evidently intended to mean Orel where Turgènief was born). Pánshin is the type of the brilliant and superficial Russian, half-educated after the Western mode, speaks several languages, plays the piano, composes sentimental songs, sketches with a clever hand, acts well in private theatricals and considers any woman as legitimate game. He and Lavrétsky are admirably contrasted. When Liza, at the fateful moment before she has made up her mind to accept Pánshin's offer, reads the newspaper report of Varvâra Pàvlovna's death, she confesses her love for Lavrétsky. They have one hour of happiness; then Fate interposes. Lavrétsky's wife is not dead: she arrives at Lavrétsky's house with her little daughter. Liza begs Lavrétsky to forgive Varvâra Pávlovna and she herself follows the example of her old nurse and takes refuge in a nunnery in a distant part of Russia. Varvâra Pàvlovna is the exact antithesis of Liza: she is beautiful but false. She immediately begins a new intrigue with Pánshin, and again Lavrétsky finds himself alone. Eight years later he revisits the house where Liza had lived. «The Nest» still belongs to the family though all the old people are dead; a new generation is living there. He catches a glimpse of their gaieties; he sees the bench on which he and Liza had sat in the bliss of their love confessed; he touches the piano: «a faint pure tone rings out and trembles in his heart.» He realizes that he had ceased to think of his own happiness; his mind is calm but he is old, old in body and in soul; but he is not unhappy; breathing a silent blessing on youth, he turns away «with sadness yet without envy» and drives slowly to his deserted home.

'Liza' belongs to a Russia vastly different from that of our day. The age in which it was written has passed, but the pictures which it gives of the period will always be treasured by mankind. It was first published in 1858, just before the Crimean War and the liberation of the serfs, and reflects the ideas that were beginning to ferment in Russia toward the end of the reign of Nicholas I. It was translated into English by W. R. S. Ralston and published in 1869 (new ed., 1884). It was included in a five-volume translation of Turgènief's masterpieces in 1889. It is included in the complete edition of Turgènief translated by Mrs. Constance Garnett and it makes the fourth volume of the complete works of Turgènief's novels translated by Miss Isabel F. Hapgood, published in 1903.

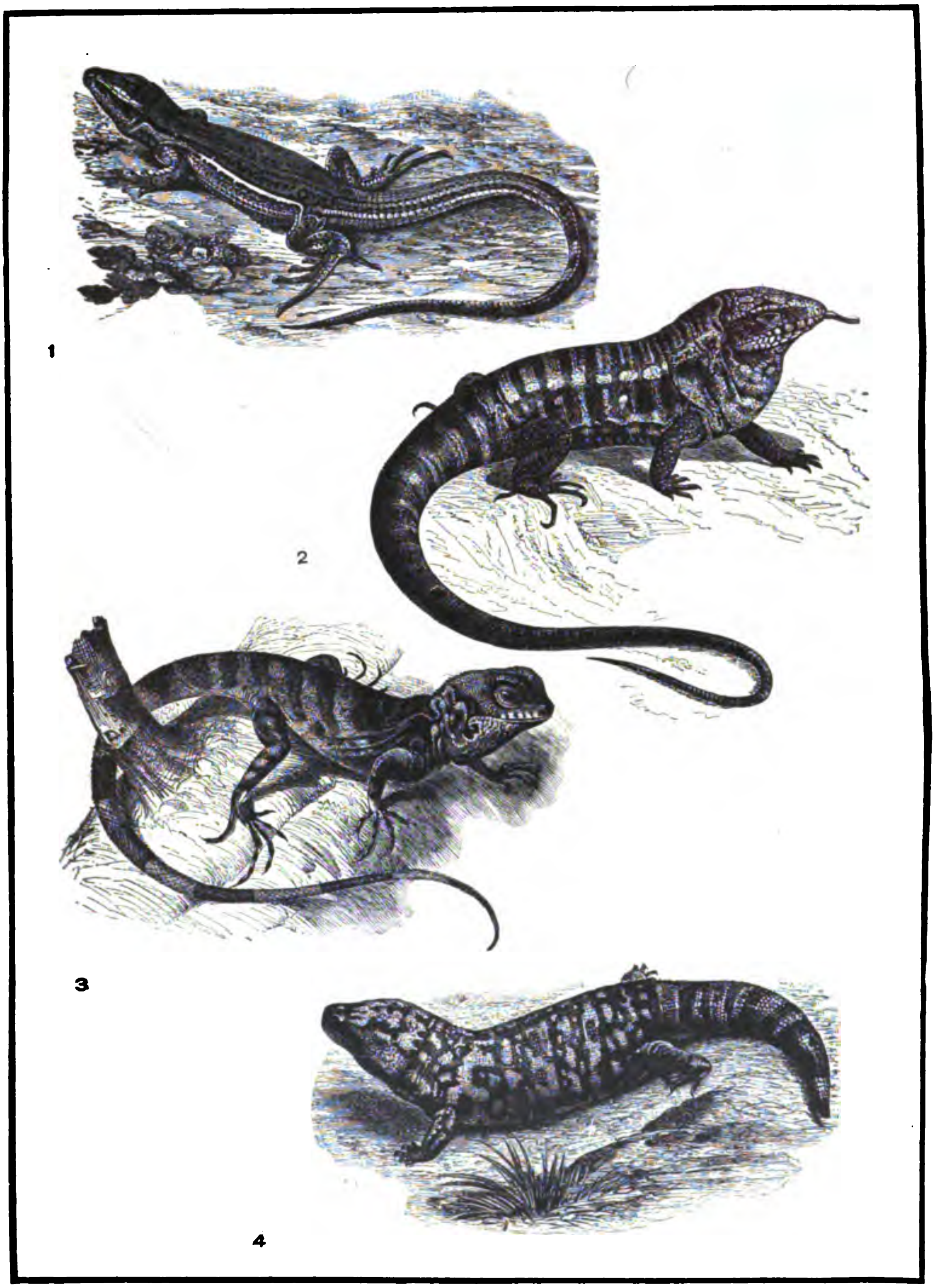
NATHAN HASKELL DOLE.

LIZARD FISH, a fish of the family *Synodontidæ* of the order *Iniomi,* remarkable for its wide mouth and very long body. It abounds inshore in tropical seas but is sometimes found in deep water. A well-known Antillean species is the *Synodus fœtens,* variously known as galliwasp, soap-fish and, in Latin-America, lagarta. It is olive above and yellow beneath, attains a length of 12 inches and is very voracious.

LIZARD POINT, or THE LIZARD, England, a headland in Cornwall, 181 feet high, forming the southernmost point of Great Britain, 24 miles southeast of Land's End, and having two lighthouses with flashes seen 21 miles, 230 feet above sea-level. The Lizard was the Promontorium Damnonium of Ptolemy. The name is also applied to the peninsula, with its broken and charming coastline, off which are the Manacle Rocks, a dangerous reef which has been the scene of many shipwrecks.

LIZARD, a subclass of reptiles, whose anatomical features and classification have been described under LACERTILIA. A general account of their habits and ecology has been reserved for the present article. Lizards as a group are of comparatively recent origin, most of the fossils known not being older than the middle of the Tertiary, when representatives of many of the modern genera were in existence. The Pleistocene rocks of Queensland have furnished skeletons of several gigantic extinct representatives of the monitor family, one of which (*Megalonia*) was about 30 feet long. The lizards, as a group, are remarkable

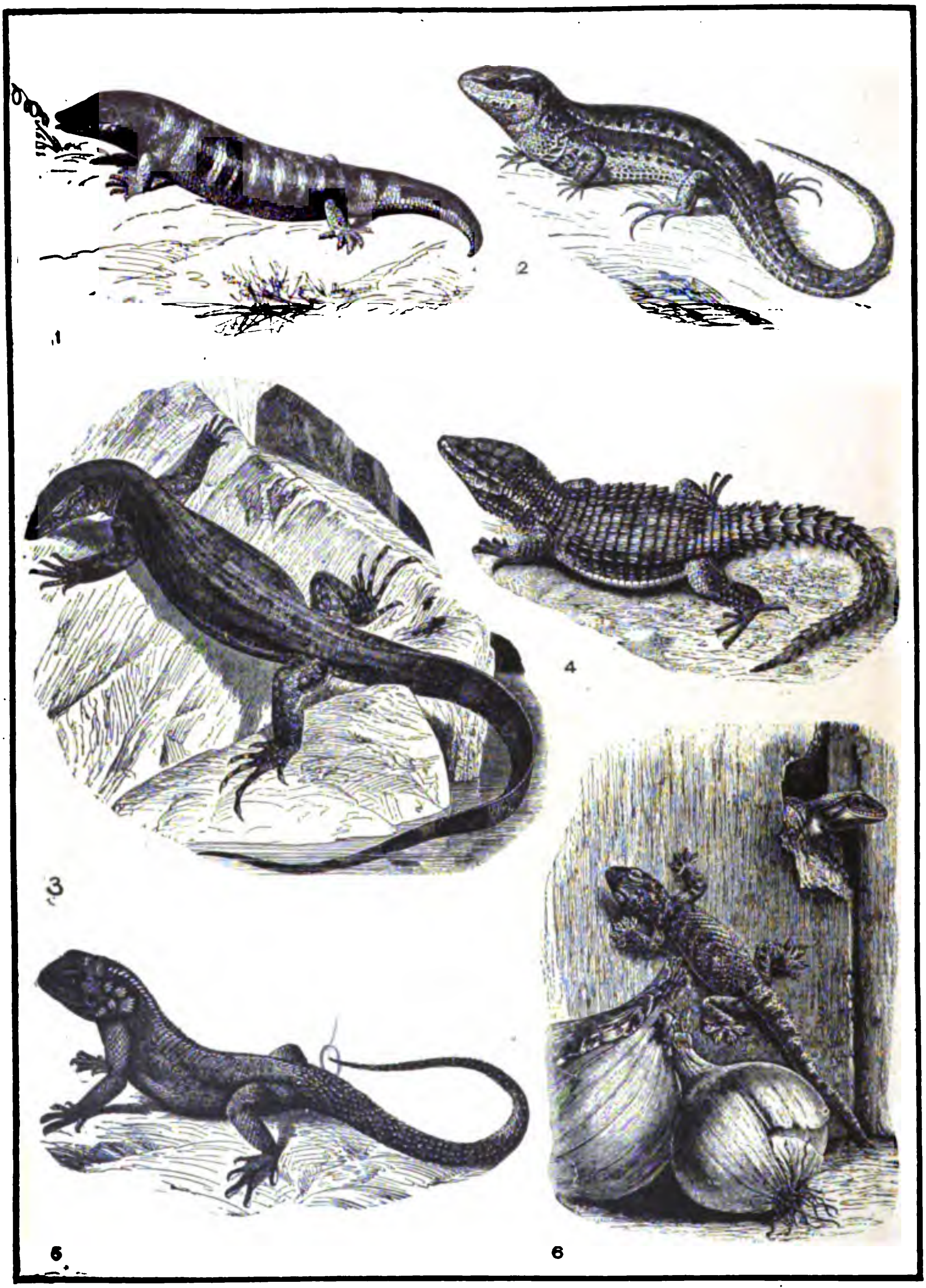
AMERICAN LIZARDS



1 Uraniscodon umbra
3 Surinam ameiva

2 Teju or Tupinambis
4 Gila Monster or Heloderma

OLD WORLD LIZARDS



1 Skink
2 Lacerta agilis
3 Nile Monitor or Varanus
4 Zonurus cordylus
5 Agama colonorum
6 Wall geckos

for the great variety in size and shape, and in the character of the skin-armature and the dentition. These variations are usually manifestly adaptations to the local environment.

Lizards abound in all the warmer parts of the world, most numerously in the tropics. In North America only three or four species pass the northern boundary of the United States, penetrating southern Ontario in the east and British Columbia on the Pacific side of the continent, where, in the arid Southwest, most of the species known in this country are to be seen. Most kinds of lizards are restricted in range, being adapted to a definite sort of environment, yet the families may have a very wide distribution. Thus that of the geckos (q.v.) is spread all over the tropical and subtropical zone of the Old World, and also in South America; and it includes both arboreal and terrestrial forms, diversified by modifications of the type to meet conditions as different as are the steaming jungles of Malaya from the sandy deserts of Persia and Africa. On the other hand the big monitors (*Varanidæ*), scattered from the Nile to the Philippines and Australia, are able to seek their prey on burning desert-ground, in and under water, and among the branches of forest-trees. This is a case of remarkable versatility, for there is little adaptive alteration of structure in the family. Again, similarity of habitat and local influence sometimes produce striking likeness in appearance in totally disconnected species, as, for example, our spiny-coated horned toads and the Australian molochs (q.v.), which are not at all related structurally. A large number of lizards belonging to widely different families have taken to a more or less complete underground life; and in these the limbs show reduction from a slight degree in some to entire absence in others, for instance the boa-like glass-snake (q.v.). Many species are good swimmers, and are of aquatic habit to a large extent, but only one truly marine species is known — the large, gregarious sea-lizard (*Amblyrhynchus*) of the Galapagos Islands, which feeds on seaweed, gathered at a considerable depth; yet it is reluctant to take to the water except for food. The American iguanas, however, although habitually residents of tree-tops, stay as near to rivers as they can, and plunge into them for safety whenever frightened.

Lizards are primarily terrestrial animals, and most sorts run with amazing swiftness, usually on all four feet, but the curious frilled lizard (q.v.) of Australia holds up its fore parts and runs on its hind legs when in haste. Except a few heavy forms, and those that dwell in burrows, lizards are extremely agile, climbing walls and tree-trunks, and running and leaping about their branches, with speed and precision; and some Oriental species, as the flying dragon (q.v.), have expansions of the skin about the forearms enabling them to make long, sailing leaps through the air.

The senses of sight and hearing are highly developed, as is requisite for their livelihood. Most species are carnivorous, the larger kinds feeding on small mammals, birds and their eggs, and the lesser reptiles, including other lizards. These are seized by a rush and leap, and are passed down the throat whole. Many of the smaller kinds live altogether on worms and insects, the latter caught in most cases by a swift dart and recovery of the sticky tongue, a method peculiarly characteristic of the chameleons (q.v.). The tongue in this group assumes a wide variety of shapes, in some families having a slender, forked form like that in snakes, and acting only as a feeler. One lizard only, the Gila monster (q.v.), is aided by the injection of poison into its victim when he bites it, and this is the most sluggish of all its race. The iguana family and certain other species eat vegetable food.

Lizards themselves are sought as prey by all sort of carnivorous beasts, birds and reptiles, in avoiding which they must rely mainly on their alertness and agility in dodging or outrunning the foe. Most of them are conspicuously colored, and many exhibit as great gaudiness as do tropical birds, so that this class of animals would seem to have been denied any benefit that might accrue from "concealing coloration" as ordinarily understood. One remarkable peculiarity of lacertilian structure, however, is perhaps protective, although the expedient is rather a costly one, namely, the ability of most lizards to part easily with the tail. This is the part of the lizard most likely to be snapped at by a captor, the more so as it is commonly held aloft when its owner runs, and breaking off easily enables the remainder of the lizard to go on running, while the baffled foe contemplates his useless booty. A new tail speedily replaces the lost member, but it is never quite as good as the original one. Some small lizards, when startled, cast off their tails with a jerk before they are touched; on the other hand, the big monitors indulge in no such sacrifice, but utilize their long and strong tails as powerful whip-like weapons of defense.

Reproduction in lizards as a rule is by a small number of eggs laid in damp earth, but a few, as the skinks, bring forth young alive. Lizards are of service to mankind in destroying insects and other vermin, and in the tropics are welcomed in native houses for that reason. The water monitor is a valuable curb on crocodiles, by devouring their eggs and young. Many lizards furnish good human food, especially the larger iguanas, that are a regular part of the aboriginal diet in South America, as are other lizards among the Blackfellows of Australia. Certain species also make amusing pets. Consult, besides general works, Gadow, 'Amphibia and Reptiles' (New York 1901); Pycraft, 'Story of Reptile Life' (London 1905); Ditmars, 'The Reptile Book' (New York 1907); Boulenger, 'Reptiles and Batrachians' (London 1914).

Ernest Ingersoll.

LLAMA, lä'mạ, one domesticated form (often specifically distinguished as *Lama glama*) of the huanaco (q.v.), the other being the wool-bearing alpaca (q.v.). It is larger than the wild huanaco (about three feet at the shoulder), and may be white, brown, black or variegated with patches of all three colors. This animal was domesticated long before the era of the Incas. When the Spaniards conquered Peru they found hundreds of thousands in use as riding animals and beasts of burden in the southern part of the country; and as they were the only domestic ungulate of the kind in South America their importance was very great. The

Spanish conquerors adopted llamas as burden-beasts, and soon long strings, in charge of a few native drivers, were passing back and forth between the mountain mines and the coast, laden with ore or bullion or with supplies, a proper burden not exceeding 120 pounds, which may be carried about 12 miles a day. Until toward the middle of the 19th century this remained almost the only means of carriage in the Cordilleras, where the endurance of cold, ability to live on the mountain herbage and sure-footedness peculiarly fitted them for this service. Only the mature males were used as burden-beasts, the smaller females being reserved for their milk and flesh, which resembles mutton, and is extensively eaten. Llamas produce only one offspring annually, so that care is needed to sustain the herds which are still numerous and valuable. Various breeds are known, but the differences are not very great. The wool, which is inferior to alpaca, is used among the native Indians for the manufacture of textile fabrics. The skin is made into leather. The dried dung is used for fuel, and the milk is also employed as an article of native diet. When overloaded these animals lie down and refuse to budge; when irritated they have the habit of kicking at their adversaries, supplemented by the ejection of food when undergoing remastication in the mouth, along with quantities of evil-smelling saliva. An unsuccessful attempt has been made to acclimatize them in Australia.

LLANDUDNO, lạn-dŭd'nō, Wales, a seaside resort of Caernarvonshire, 40 miles southwest of Liverpool, on the London and Northwestern Railway, 227 miles northwest of London. It has a magnificent marine drive around Great Omre Head, on which is the ancient oratory of Saint Tudno. Druidical remains abound in the neighborhood. Up to 1850 Llandudno was a poor fishing village but it has since become a fashionable resort with golf links, palatial hotels and all the appanages of such places. The water-supply, gas, power and electric-light plants and refuse incinerator are municipally owned. There are also municipal slaughter-houses and markets. Pop. 10,400.

LLANELLY, lă-nĕth'lĭ, Wales, a seaport town of Carmarthenshire, on the Burry Inlet, 14 miles southeast of Carmarthen. It is the outlet for the products of a great mining district, with extensive collieries, iron-foundries, copper works, tin-plate works, potteries, chemical works and lead and silver works. The trade is facilitated by commodious docks and ample harbor accommodation. It is the seat of a United States consular agent. Pop. 32,071.

LLANES, lyä'näs, Spain, seaport on the north coast, in the province of Oviedo, on the Bay of Biscay at the embouchure of the Carrocedo, 45 miles west of Santander. It has narrow, irregular streets lined with many ancient dwellings, an old monastery and a 14th century Gothic church. A meteorological station is now housed in the monastery and part of the buildings are used for school purposes. It has a large coasting trade carried on in light-draught vessels. This trade is concerned mainly with agricultural products, timber, butter, fish, etc. Pop. 21,700.

LLANGOLLEN, lăn-gŏth'lĕn, Wales, town and summer-resort of Denbighshire, on the Dee, 10 miles southwest of Wrexham and 202 miles from London, on the Great Western Railway. There are many interesting ruins in the town and in its vicinity, including a famous 14th century bridge, two monasteries and an abbey church of the 13th century. There are linen and woolen mills, collieries and iron works, breweries and quarries. Pop. 3,240. Consult Simpson, Robert, 'History of Llangollen' (3d ed., Llangollen 1852).

LLANO ESTACADO, lä'nō äs-tä-kä'dō, or **STAKED PLAIN,** Tex., an extensive plateau forming part of the Great Plains of the eastern slope of the Rocky Mountains, east of the Pecos River, in northwestern Texas and eastern New Mexico and the source of many rivers flowing to the Mississippi and the Gulf of Mexico. It has an area exceeding 40,000 square miles, and is dry and almost woodless; grass is produced for cattle in the rainy season; water is obtained by boring, and irrigation necessary for the growing of crops. In the north the plateau has a general elevation of about 5,000 feet, but it slopes to the south where it is not over 3,000 feet high. The name is Spanish and means a plain with stakes, referring to the many stalks of the Yucca or Spanish bayonet which abound in the region.

LLANOS, lä'nōs or lyä'nōs, the name given in the northern part of South America, particularly in Colombia and Venezuela, to vast plains, almost entirely level, and interrupted only at intervals by detached elevations, called in Spanish mesas. The superficial area of the llanos is estimated at 300,000 square miles; they extend from the delta of the Orinoco inland to the Yapura, a tributary of the Amazon. A large portion of them is sandy and without much vegetation, except on the banks of the rivers and during the wet season. At this period great stretches are inundated to the depth of 12 to 15 feet, owing to the rivers overflowing their banks. The villages must, therefore, be built on the elevated ground. Considerable portions are covered with forest; in the grassy regions great herds of cattle pasture; the climate is warm and moist. Not including the forest section, nor any of the foot-hills of the Andean Cordillera, the llanos of the northern part of South America would cover only about 150,000 square miles. The inhabitants of these plains are called Llaneros. They are a hardy, vigorous race, and although mainly of Indian extraction are proud of their descent from the first Spanish colonists; but their mode of life resembles more that of the Indians than that of their boasted ancestors. Farther to the south such plains are called pampas.

LLANQUIHUE, lyän-kē'wä, a lake in the province of the same name, in Chile, South America. Largest lake in Chile; nearly circular in form, about 30 miles in length and the same in width. It is a deep lake, with only very small inlets, being mainly fed through the porous granite rocks of the region, and having its outlet in the Maullen River.

LLORENTE, Juan Antonio Don, hoo-än' än-tō'nē-ō dōn lyō-rän'tā, Spanish historian: b.

Rincon de Soto, near Calahorra, Aragon, 30 March 1756; d. Madrid, 5 Feb. 1823. He studied theology at Tarragona and Madrid; was ordained priest in 1770; was doctor in canon law, chancellor of the University of Toledo; was commissary of the Inquisition at Logrono in 1785, and general secretary of the Inquisition at Madrid in 1789. He was commissioned in 1793 to draw up plans for a general reform of the procedure of the court. During the crisis of 1808 he sided with the Bonapartists, superintended the measures for the abolition of monastic orders and made a close examination of the archives of the Inquisition. His greatest work is the ‘Critical History of the Spanish Inquisition’ (1815–17), which, however, has no authoritative standing among scholars. He wrote also ‘Memoirs Relating to the History of the Spanish Revolution’ (1815–19). His autobiography was published in 1818.

LLOYD, loid, **Arthur,** Anglican clergyman and missionary to Japan, who, engaging in the study of Buddhism, early Christianity and patristic literature, opened new lines of investigation and made important discoveries concerning the early contact of the two religious systems, revealing the great borrowings of the one from the other, especially of the Buddhists from the Gnostics (q.v.). Consult his ‘Wheat among the Tares’ (1908); ‘Shinran’ (1910); ‘Every Day Japan’ (1909), and his contributions to the *Transactions* of the Asiatic Society of Japan.

LLOYD, Charles Harford, English musician: b. Thornbury, Gloucestershire, 1849. He displayed musical talent early, and at 10 was organist of Rangeworthy Church, and after 1862 studied music with Barrett of Bristol, confining his attention almost entirely to Bach and Beethoven. He graduated from Oxford, where he came under the influence of Stanier and definitely determined to make music his calling. He conducted the Gloucester musical festivals of 1877 and 1880, became organist of Gloucester Cathedral in 1876 and of Oxford Cathedral in 1882. Since 1892 he has been precentor and musical instructor at Eton. Among important compositions of his are the cantatas of ‘Hero and Leander’; ‘The Song of Balder’; ‘Andromeda’; ‘Alcestis’; ‘Song of Judgment; ‘Longbeard's Saga.’ He has also written many canticles and anthems for the church, glees, madrigals and part songs, choruses, etc., and several instrumental pieces.

LLOYD, Francis Ernest, American botanist: b. Manchester, England, 4 Oct. 1868. In 1891 he was graduated at Princeton University and studied also at the universities of Munich and Bonn. In 1891–92 he was instructor in Williams College; in 1892–95 professor of biology and geology; in 1895–97 of biology at Pacific University. From 1897 to 1906 he was adjunct professor of biology at Teachers' College, Columbia University. In 1906 Professor Lloyd was investigator of the Desert Botanical Laboratory, Carnegie Institution, Washington; in 1907 instructor at the Harvard Summer School and cytologist of the Arizona Experiment Station. From 1908 to 1912 he was professor of botany at the Alabama Polytechnic Institute and in the latter year was appointed MacDonald professor of botany at McGill University, Montreal. In 1905–08 he edited *The Plant World,* and has published ‘The Teaching of Biology in the Secondary School’ (1904); ‘The Comparative Embryology of the Rubiaceæ’ (1902); ‘The Physiology of Stomata’ (1908); ‘Guayule, a Rubber Plant of the Chihuahuan Desert’ (1911), also various other botanical papers, including studies on transpiration, stomata, tannin, rubber, cotton, etc.

LLOYD, George. See GEORGE, DAVID LLOYD.

LLOYD, Henry Demarest, American writer on economics: b. New York, 1 May 1847; d. 28 Sept. 1903. He was graduated from Columbia University; lectured on political economy in New York schools; studied law and was admitted to the bar in 1869. In 1872 he went to Chicago where he was employed on the Chicago *Tribune* till 1885, the latter part of the time as a member of the editorial staff. His later life was devoted to writing. His publications include ‘A Strike of Millionaires against Miners, the Story of Spring Valley’ (1890); ‘Wealth against Commonwealth’ (1894), a history of the growth and methods of the Standard Oil Company; ‘Labor Copartnership’ (1899), notes of visits to various co-operative shops and farms in Great Britain; ‘A Country without Strikes’ (1900), an account of the history and workings of compulsory arbitration in New Zealand; and ‘Newest England’ (1900); ‘A Sovereign People: A Study of Swiss Democracy’ (1907); ‘Men, the Workers’ (1909); ‘Lords of Industry’ (1910); ‘Mazzini and Other Essays’ (1910). He made the labor question his special field of research, and was an advocate of co-operation and a believer in socialistic — or, as he called it, democratic — control of industry, to which he maintained that social evolution was leading. He possessed the power of presenting economic facts in an unusually interesting manner, especially his ‘Wealth against Commonwealth,’ though compiled from court records and other official documents, is written with a force and vividness which give it real literary quality.

LLOYD, John Uri, American chemist and author: b. West Bloomfield, N. Y., 19 April 1849. He was educated in private schools; was professor of pharmacy at the Cincinnati College of Pharmacy, 1883–87; professor of chemistry at the Eclectic Medical Institute, 1878–1900, and president of the Eclectic Medical Institute, 1896–1904. He has been president of the Lloyd Library since its inception, and is senior member of the firm of Lloyd Brothers, manufacturing pharmacists and chemists of Cincinnati, Ohio; and in the laboratory has devoted his life work to plant pharmacy, including investigations of plant alkaloids and proximate principles. He has contributed very largely to current chemical and pharmaceutical literature, and outside his professional writings has made special studies in the dialect, superstitions and folklore of northern Kentucky. His best-known publications are ‘The Chemistry of Medicines’ (1881); ‘Supplement to King's American Dispensatory’ (1885); ‘King's American Dispensatory,’ revised and rewritten with H. W. Felter, M.D. (1898–1900); ‘Elixirs, their History and Preparation’ (1892); ‘A Study in Pharmacy’ (1894); ‘Etidorpha, the End of Earth’ (1895); ‘The

Right Side of the Car' (1897); 'Stringtown on the Pike' (1900); 'Warwick of the Knobs' (1901); 'Red Head' (1903); 'Scroggins' (1904); 'The Eclectic Alkaloids, Resinoids and Concentrations' (1910); 'History of the Vegetable Drugs of the Pharmacopeia of the United States' (1911); 'A Study of Digitalis' (1912), and 'A Study of Coca' (1913). He is the author of the article on "Pharmacy" in the 'Encyclopedia Americana.' He is a member of the Society of Colonial Wars, Sons of the Revolution, Sons of the American Revolution, Authors' Club of New York, New York Deutscher Apotheker Verein (honorary), Franklin Inn Club and Franklin Institute of Philadelphia, the Literary Club of Cincinnati, and is also a Fellow of the Royal Society of Arts, England.

LLOYD, Nelson McAllister, American journalist and author: b. Philadelphia, 18 Dec. 1873. He was educated at the Germantown Academy, and was graduated in electrical engineering at the Pennsylvania State College in 1892. He engaged in newspaper work on the New York *Evening Sun,* of which he was city editor from 1897 to 1905. He retired in 1908 from newspaper work. He has contributed many historical sketches and short stories to magazines and has also published 'The Chronic Loafer' (1900); 'A Drone and a Dreamer' (1901); 'The Soldier of the Valley' (1905); 'Mrs. Radigan' (1906); 'Six Stars' (1907); 'The Robberies Company' (1908); 'David Malcolm' (1913). He is a member of the National Institute of Arts and Letters.

LLOYD'S, an incorporated firm engaged in marine insurance in London, its other activities being in the line of collecting and publishing news of shipping. The corporation has rooms in the London Royal Exchange. Members are admitted by subscription and the affairs of the institution are conducted by a committee. Reports are received daily from all foreign ports, and this information is posted in the common or merchants' room. This service requires an enormous staff of correspondents and the conducting of a chain of special signal stations to which ship captains are required by law to report certain maritime news when passing. Besides this there are other rooms for the use of the underwriters and for ship-auctions, a library, restaurant, etc. Lloyd's list, containing shipping reports, is published daily, and various other publications relating to shipping are also issued. (See also LLOYD'S REGISTER). Originally the London underwriters met at Edward Lloyd's Coffee-house, that institution dating as far back at least as 1688; hence the name. Consult Martin, F., 'History of Lloyd's' (London 1876).

LLOYD'S BONDS, in England, from 1850 to 1870 a well-known commercial security; mostly instruments under the seal of a railway or other such company admitting the indebtedness of the company to a specified amount, with a covenant to pay such amount with interest within a stated time. These companies had generally statutory authority to borrow only when a certain amount (usually the whole) of their capital had been subscribed and a specified portion paid up; their power of borrowing must also be exercised with the sanction of a general meeting. Such restrictions were severely felt by companies whose works were being constructed. A barrister, John Horatio Lloyd, relieved the companies from this embarrassment by taking advantage of the fact that companies, though prevented in such cases from borrowing, could contract debts in any other way and acknowledge their obligations in various forms. He introduced a form in which such acknowledgments would become almost as binding on the grantors as a statutory debenture, and so become sufficiently marketable. Railway companies now having ample borrowing powers, the necessity for these instruments no longer exists.

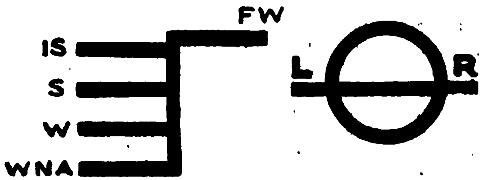
LLOYD'S REGISTER, a shipping record of vessels in commission and their ratings according to construction, physical condition and equipment. Lloyd's Register had its beginning in 1799, when the Underwriters' Registry, or Green Book, published by a committee of Lloyd's (q.v.) was denounced as unfair by the British ship owners whose vessels were therein given arbitrary ratings. The ship owners formed an association of their own and began publishing the Red Book, with ratings according to their own judgment. The rivalry continued until 1833, when Lloyd's engineered a combination of the two publications under the control of the ship owners, and they accepted the name "Lloyd's Registry of Shipping" as the title. The society has a staff of skilled surveyors who examine vessels periodically, changing their rating as occasion demands. They are also detailed to watch the construction of vessels in the yards, make inspections and tests of steel used, strength of cables and chains and examinations of equipment. The rating 100 A 1 is the type of wholly approved ship; 90 A 1 for a ship not wholly approved in build; 100 A — for a ship approved as to build, but lacking as to equipment. The general committee of the society is located at London; there are subcommittees at Liverpool, Glasgow and in the United States. Besides the Register the society publishes a separate register of American yachts and motor-boats, and rules and regulations for the building of steel vessels and yachts.

LOA, the African eyeworm of man. One of the Filariidæ among the Nematoda (q.v.), conspicuous because of its migrations through the subcutaneous connective tissue of the human body, a habit which brings it at times in front of the eyeball. It has often been removed from this place and said to occur in each eye. Cases in North America are all imported from the west coast region of Africa, which is its proper home. It is transmitted to man by the bite of the mangrove fly.

LOAD. See ELECTRICAL TERMS.

LOAD LINE, a mark placed by recognized authority on the side of a vessel to indicate the maximum depth to which she may be legally loaded under the British law. It is required to be 12 inches in length and one inch in width, and is accompanied or enclosed by a circle struck from the centre of the upper edge of the line. Generally the line is made longer than the required 12 inches, and extends beyond the circle in both directions. On wooden ships the line and the circle are to be cut into the wood at least one-fourth of an inch deep. On steel vessels the line and circle are to be painted on — in white or yellow, if the hull is dark; in black if the hull is light in color. In the case of the steel ship it is required that the centre of the circle shall be indented with a punch, so that if painted over for any reason the point may be identified beyond any question. The load line as indicated is for the summer loading of ships traversing salt water. Several modifications have been allowed by law: a slightly deeper loading for the Indian Ocean in summer, and a still deeper loading if the vessel is to navigate only in fresh water. In the other direction a lighter loading is required for winter, and a still lighter loading if the winter voyage is to be made in the stormy north Atlantic Ocean. These modifications of the load-line are painted alongside of the line and circle somewhat in the form of a gridiron — as shown in the diagram.

LOAD LINE.



The signification of the letters is as follows:

FW, fresh water load-line (steamer).
IS, summer load-line, Indian Ocean.
S, summer.
W, winter.
WNA, winter, north Atlantic.
F, fresh water sailing ships.

There are three executive bodies authorized by the British law to affix or to approve these marks: Lloyd's Register, the Bureau Veritas and the British Corporation. Initial letters (LR, BV or BC) are usually placed at the ends of the line which project beyond the circle, showing which of these bodies has verified the correct placing of the line.

The load line is a development of the former «Plimsoll mark» established by Samuel Plimsoll (q.v.) in the effort to prevent the hazard to the lives of seamen in the overloading of vessels. Consult Lloyd's Register, 'Rules and Regulations for Steel Vessels' (or 'for sailing vessels,' as the case may be) published annually in London.

LOADSTAR. See LODESTAR.

LOAM, soil consisting of a mixture of clay, sand and lime, with animal and vegetable matters in intimate mixture. The clay varies from 20 to 50 per cent; the proportion of lime is usually not more than 5 per cent. Loamy soils are among the best and most fertile; they are not stiff and tenacious like clay soils, and they are much more fertile than sandy soils. Even in mere mechanical properties, they are superior to both. The «clay» used for bricks is often really a loam in which the proportion of true clay is large. In Italy, France and some other countries, walls are made of loam beaten down between planks placed at the requisite width. These walls become very solid and last for centuries. The loam used in foundries consists of a mixture of clay, sand and horsedung, ground up with water in a sort of mortar called a loam-mill. When cold, the loam has sufficient consistency to be struck up to any desired outline by means of a «loam-board.» (See CLAY; SAND; SOIL). Consult Van Slyke, 'Fertilizers and Crops' (New York 1912) and Hilgard, 'Soils' (ib. 1904).

LOAN, anything lent or given to another on condition of return or payment. In civil law loans are considered to be of two kinds — *mutuum* and *commodatum;* the former term being applied to the loan of such articles as are consumed in the use, as provisions or money; the latter to the loan of such articles as must be individually returned to the lender. The acknowledgment of a loan of money may be made by giving a bond, a promissory note or an I. O. U.

LOANGO, French West Africa, the chief port of the French colony, 100 miles north of the Kongo River. Under native rule it was a flourishing city of 15,000 souls, but is now reduced to a few wharves and warehouses. Steamers are unloaded by means of lighters. There is a submarine telegraph connecting it with Europe.

LOANGO, West Africa, a district on the Atlantic Coast, extending 200 miles to the north from the mouth of the Kongo. The coast is thinly wooded; inland the surface rises, but the interior is a succession of plateaus. Palm-oil, gum, wax, copper, rubber, orchil and ivory are exported. Cotton, coffee and bananas are the chief crops. Loango was formerly a part of the native kingdom of Kongo and is now divided between French Kongo, the Portuguese Kabinda and the Belgian Kongo. The native population are of small size but are skilled in many industries, especially as weavers of bast and straw. Loango is the principal city.

LOBACHEVSKY, or **LOBATCHEWSKY, Nicholas Ivanovitch**, Russian mathematician: b. Makareif, Nyni-Novgorod, 1793; d. 24 Feb. 1856. He entered the University of Kazan in 1807, became assistant professor of mathematics in 1814 and extraordinary professor in 1816. In 1823 he became ordinary professor retaining his chair (in addition being for 19 years rector) until 1846, when he fell into disfavor. Unlike many professional men, he was a good business man and his administration of the affairs of the university was marked by many beneficial changes. He organized the force of teachers, and even studied architecture, so that when the new buildings were erected he supervised their erection, economized space and saved thousands of dollars. He wrote his 'Pangéometrie' in 1855, giving the result of his long years of geometrical studies, and presented it to the university. He was one of the first thinkers to apply a critical treatment to the Euclidean principles of geometry. He gave his first contribution to the theory of hyper-geometry in a lecture at Kazan in 1826, but later wrote several treatises on the subject. He also wrote a treatise on algebra (Kazan 1834) and contributed many other articles on mathematics. His complete works were edited by Janischevsky (1870) and have been translated by several writers. His collection of geometrical writings was published in Kazan in 1883, the first volume containing Russian articles only, and the second and last volume containing the French and German articles. For his geometry consult 'New Principles of Geometry with Complete Theory of Parallels,' translated by Halsted (Austin, Tex. 1897). Consult also Engel, F., 'N. I. Lobatchewsky' (Leipzig 1899).

LOBBY, The, a class of persons who seek to influence legislation outside of the regular legislature which has come in the United States to be known derisively as the "third chamber." The term was originally applied to the waiting-rooms of legislative halls, and then to those persons who frequented these rooms for the purpose of interviewing legislators with a view to influencing their votes. The lobby includes both those who are regularly employed in the work, and those who on particular occasions wish to promote or oppose some specific legislation. All large corporations and firms have regular paid lobbyists at Washington and at State capitals where legislation is likely to affect their interests. Women as well as men are employed as lobbyists, and are said to be very successful. The lobby is not in theory, nor necessarily in practice, a corrupting agency. It may furnish an entirely legitimate and desirable method of giving legislators necessary information in regard to certain laws; but it may also be, and often is, the means of obtaining legislation in the interests of a few without regard to the public good. The methods of the lobby differ with the character of the lobbyist and of the legislator approached. They vary from the legitimate presentation of facts and argument in regard to a law to the use of bribery, threats of preventing re-election, etc.; and include the obtaining of letters and petitions from constituents, the employment of press articles and social attentions. The successful lobbyist must thoroughly understand the men with whom he has to deal and the methods of legislation; it has been found, therefore, that former members of the legislature make the most successful and sometimes the most dangerous lobbyists. The dangers of the lobby are due to three chief causes: (1) the large number of special and private bills, all of which cannot be fully considered at the regular sessions; (2) the system of referring all bills to committees, and accepting, as a rule, the report of the committee, so that the lobbyist has practically but few men to deal with; (3) the secrecy which attends the work of the lobby, giving the public no effective means of knowing or dealing with its evils. To oppose the grosser evils of the lobby both Federal and State laws attach heavy penalties to giving or taking a bribe for legislation. Many of the States also have lessened the number of bills to be presented by forbidding in their constitutions the passing of special acts in certain cases. Among States that have passed enactments to lessen the lobbying evil are — California, Georgia, Utah, Tennessee, Oregon, New York, Montana, Arizona and South Dakota. Massachusetts has sought to lessen the secrecy by requiring every promoter of a law in the interest of others to be registered, with the name and address of his employer and a statement of the matter on which he is employed. This law has had the effect of giving legal sanction to the lobbyist's work, improving the character of the lobbyists, and of lessening, though not entirely preventing, the evils attending secrecy. The lobby sent to Washington to oppose the Underwood Tariff Bill of 1913 drew forth strong criticism and warning from President Wilson, and the operations of the National Association of Manufacturers were in this connection severely animadverted on by the Investigation Committee in 1914. Consult Bryce, 'American Commonwealth'; Bridgman, 'The Lobby' (in *New England Magazine*, n. s. Vol. XVI, p. 131); Tanner, H. C., 'The Lobby and Public Men' (Albany 1888); Reinsch, R. S., 'American Legislatures and Legislative Methods' (New York 1907); 'First Report of the Interstate Commerce Commission' (Washington 1887); and the 'Cyclopedia of American Government.'

LOBELIA, a genus of annual and perennial herbs and a few undershrubs of the family *Lobeliaceæ*, closely allied to the harebells. More than 200 species are distributed throughout the temperate and tropical zones, especially in damp soils. They are characterized by alternate, usually narrow leaves and two-lipped tubular flowers (three petals forming one lip and two the other), arranged in terminal racemes. Several of the species are highly prized as garden plants, the best known being the cardinal-flower (q.v.), the great lobelia (*L. syphilitica*), both common natives in marshy grounds and along streams; *L. Erinus*, a favorite African plant for edging flower beds; and *L. fulgens*, a Mexican species, which like the first named has brilliant red flowers. The other two have blue blossoms. They are all of simplest culture. Some species have been used in medicine, and one common species, *L. inflata*, is called Indian tobacco because its dried leaves were extensively smoked by the southern Indians, who enjoyed the narcotic effect in spite of the bitter flavor. Lobelin, lobelacrin, and lobelic acid are organic derivatives.

LOBENGULA, lō-bĕng-goo'lä, king of the Matabeles (see MATABELELAND): b. about 1833; d. 1894. He was a son of Mosilikatse, whom he succeeded in 1870. Fixing his capital at Bulawayo (q.v.), he made himself a powerful opponent of Western civilization, and prohibited his people, on pain of death, from accepting Christianity. After years of diplomatic effort, following the discovery of gold in his domain, Great Britain, by treaty in 1888, acquired suzerainty over his kingdom, and in 1890 the British South Africa Company obtained from him permission to settle in Mashonaland (q.v.), paying him a stipulated rent. After preparing to hold the country and work the gold mines, the company provoked the enmity of Lobengula, who began against the English a war which resulted in his disastrous defeat, after shocking slaughter of his men by Maxim guns. Bulawayo was taken, and Lobengula fled. During his flight he ambuscaded and killed Major Wilson and a British detachment, but the contest ended with his own death. Consult Wills and Collingridge, 'The Downfall of Lobengula' (London 1894).

LOBITO BAY, Portuguese West Africa, seaport and railway terminus of Angola. It is the terminus of the railroad to Katanga. There is a good harbor permitting ocean-going vessels to dock.

LOBLOLLY BAY, or TAN BAY, an elegant pyramidal shrub or tree (*Gordonia lasianthus*) of the tea family, which covers considerable tracts of swampy coast along the Gulf of Mexico. It is a handsome tree, sometimes 50 or 60 feet tall, with evergreen leaves and large white fragrant flowers. Its bark is used in tanning.

LOBNOR, Lake, a lake of central Asia situated on the border of the desert of central Asia and near the base of the Altyn Tagh Mountains in East Turkestan. It is fed by the Tarim, of which the lake is merely the sink. According to the Chinese the lake was formerly of much greater area than at present but modern explorers do not support this view. The lake's borders are reed-covered marshes. The portions of the lake distant from the mouth of the Tarim are salt. Consult Hedin, Sven, 'Trans-Himalaya' (New York 1912).

LOBO, Francisco Rodrigues, Portuguese author: b. Leiria, about 1575; d. about 1627. Nothing is known of his life beyond the fact that he came of a wealthy family; that he studied at the University of Coimbra where he took the degree of licentiate about 1600; and that he lived at ease near his birthplace, writing pastoral and other verse. His first volume of verse, 'Romances' (1596), was written in Spanish, but thereafter he wrote in his native Portuguese, with the exception of his last work, a rhymed welcome to Philip III in 1623. In his day Spanish was the language of Portuguese high society and Lobo rendered an important service to his native land by writing in Portuguese at the critical period in the history of that language during the Spanish domination of Portugal. 'Primavera,' a novel, appeared in 1601, and was continued in 'O Pastor Peregrino,' in 1608, and 'O Desenganado,' in 1614. Although considered his best prose they are dull for the modern reader, for whom their only relieving features are the pastoral songs or *serranilhas*. In his eclogues he followed Camoens closely and they are poor imitations at best. His *redondilhas* are infinitely superior, due perhaps to his reliance upon true national inspiration. His 'Côrte na Aldeia' contains an interesting series of philosophic and literary discussions in the form of dialogues. Lobo also wrote an epic in 20 cantos, 'El Condestable de Portugal' (1610), but it falls far below the level of his other works. Lobo ranks as one of the leading authors of Portugal because of the purity and elegance of his style. His works went through several editions in the 17th and 18th centuries — a remarkable feat for Portugal. An edition of his works appeared at Lisbon in one volume in 1723, and a less complete edition there in four volumes (1774). Consult Bouterwek, F., 'History of Portuguese Literature' (London 1823) and la Silva, I. F., 'Diccionario bibliographico portuguez' (Vols. III, IX, Lisbon 1859; 1870).

LOBOC, lō-bŏk', Philippines, a pueblo of the province of Bohol, situated in the southern part of the province on the Socar-Vilar-Loay River, three miles from its outlet, and 12 miles east of Tagbilaran, the provincial capital. It is on the road leading from the coast. Pop. 10,756.

LOBOS, lō'bōs, or **SEAL ISLANDS,** Peru, two groups of small islands in the Pacific, 12 miles from the mainland, so named from the Spanish *lobo*, "seal," large numbers frequenting the islands. The largest and most northerly is Lobos de Tierra, five miles long and two broad. They were famous for their extensive deposits of guano, which have been depleted.

LOBSTER, the name of certain large crustaceans of the crab group, and especially of the genera *Homarus*, *Nephrops* and *Palinurus*. To the first belong the common European and American lobsters (*Homarus gammarus* and *americanus*). *Nephrops* differ chiefly in possessing 19, instead of 20, pairs of gills, and its most important species is the Norwegian lobster (*N. norvegicus*). To *Palinurus* belongs the rock-lobster or marine crayfish (*P. vulgaris*) of Europe, as well as some tropical species, all of which differ from the common lobster in the absence of the large claws, while they possess long rigid antennæ and spiny shells. A large and handsome species of this group is abundant in West Indian waters.

The American lobster is found along the western Atlantic Coast from Delaware to Labrador; from the shore to a depth of 100 fathoms. It is most abundant on the shores of Maine and Nova Scotia and less common on the New Jersey coast. Though living amid a variety of surroundings, the lobster prefers rocky bottoms, on which it reaches the greatest size and abundance, probably a direct result of a more plentiful food supply. Like many fishes, but to a much less degree, the lobster is migratory, moving into shallow water in the spring and returning to greater depths as the water grows colder in the fall. This habit, however, is very far from being universal, and many lobsters remain in shallow waters throughout the year. The food of the lobster consists of all kinds of animals, both living and dead, and to a less extent of vegetable matter, the indigestible parts of which are regurgitated. At times they are cannibalistic. Although so well protected by their hard shells, powerful claws and burrowing habits, lobsters have many enemies besides man. The most important of these are bottom-feeding fishes, such as the cod, tautog, skate and dogfish, which destroy great numbers of young lobsters when two to six inches long, as well as the egg-bearing females and moulting adults. During the free-swimming larval stages great numbers probably fall a prey to surface-feeding fishes like the menhaden and herring, though little direct proof of this exists. The number of eggs produced by a female lobster varies from 3,000 to nearly 100,000, according to the size and age of the animal, maturity being attained at an age of three or four years and a length of about 8 to 12 inches. The great majority (about four-fifths) lay their eggs during the summer, the remainder during the fall and winter, and it is probable that each female lays once in two years. After extrusion the eggs are borne on the appendages attached to the lower side of the abdomen or tail of the female, where they remain undergoing a slow development for 10 to 11 months, most of those laid during the summer hatching in June of the following year. After hatching, the young passes a period of six to eight weeks as a free-swimming pelagic larva, which moults five or six times, with corresponding changes in form and color. By this time it has assumed the form of the adult and is about three-fourths of an inch long. It now sinks to the bottom and burrows into the gravel or hides in rock crevices near shore. At the end of the first year it is about four or five inches long and has moulted from 14 to 17 times, after which growth is much less rapid and moulting less frequent. The rate of growth varies greatly according to the food supply and other conditions, but a lobster of 10 or 12 inches is about five years old. A great age and size are sometimes attained, individuals weighing upward of 40 pounds being recorded, though even 25 pounds is very rarely reached.

The toothsomeness of the American lobster was early recognized and a regular fishery has existed on the Massachusetts coast for nearly a century. Owing to a rapidly extending depletion of the fishing grounds and a consequent diminution in the size and number of lobsters, the centre of the fishery has shifted northward, first to Maine and then to the British provinces. The lobster fisheries of the United States in 1913 employed 4,508 persons with a capital investment of $2,460,898. The catch numbered 8,832,017 lobsters, weighing 12,067,017 pounds, of a value of $2,394,822. Between the years 1889 and 1913 there was a decrease of 18,504,556 pounds, or 60 per cent, while the receipts of 1913, compared with those of 1889, increased 178 per cent. The price of fish in Maine rose from 1.8 cents per pound in 1880 to 19.8 cents in 1913, or 11 times greater.

There are no better oyster grounds in the world than the eastern provinces of Canada, from Grand Manan to the Labrador boundary. Not so many years ago the finest lobsters could be bought and sold for 50 cents per 100. In Chaleur Bay they occurred in such numbers that farmers used them by thousands to manure the land. Canneries began to be established about 1870, and in 1910 there were 677 canneries in the eastern provinces. The catch in 1890 amounted to 11,559,984 pound cans, while the quantity shipped to market in shell amounted to 104,940 hundredweight, the whole of a value of $1,648,344. During the next 20 years the quantity taken remained almost stationary, but the value greatly increased. In 1910 the total was 9,071,600 pound cans, with shipment in shells of 103,907 hundredweight, with aggregate value of $3,657,146; in 1915–16 the catch was 445,277 hundredweight, and value $4,506,155. As measures toward maintaining the lobster supply, laws have been enacted fixing fines for the possession of egg-bearing lobsters or those below a specified minimum size, and recourse has been had to artificial propagation. In the latter practice many millions of eggs are annually taken from the bearing lobsters, artificially hatched, and the larvæ distributed by the fish commissions of the United States and the British provinces. In 1914 our bureau planted upward of 194,670,000 of fry, and the Canadian government operates on an even more extensive scale. The beneficial results have been scarcely apparent, but the recent successful rearing of lobsters beyond the larval stages has introduced a more hopeful outlook. The methods of the lobster fishery are very simple and uniform. Use is made of a trap or pot, a box-like affair generally made of laths placed about one inch apart, and with a funnel-shaped opening of coarse netting placed in one end. The pot is baited with otherwise useless fish, weighted with stones, and lowered to the bottom by means of a rope to the upper end of which a buoy, with the owner's private mark affixed, is attached. The pots are visited daily, and the lobsters, which after entering are unable to find their way out, removed. They are kept alive in floats until a sufficient number for shipment has been gathered. Besides those sold in the shells, large quantities of the meat are canned, particularly at Portland.

Consult especially the elaborate account of the American lobster by Herrick in 'Bulletin of the United States Fish Commission' for 1895, in which full bibliographical references will be found; also Barnes, E. W., 'Methods of Oyster Protection and Propagation' (Providence 1911); Herrick, H. F., 'Natural History of the American Lobster' (Washington 1911); and the evidence laid before the Canadian Fisheries' Commission on 'Lobster Fishery in Quebec and the Maritime Provinces' (Ottawa 1909–10).

LOBWORM. See LUGWORM.

LOCAL GOVERNMENT, Principles of. In all countries of any size the work of government is divided between the central authorities and officials in local districts; and the general character of the government as a whole is affected largely by the system of local government and the relations between the central and local authorities. The principles involved in local government systems are more complicated than are often realized; and governments which resemble each other in the main features of the central government may differ radically in their machinery of local government. This article calls attention to some of the leading factors to be considered in the study of local government, with illustrations from some of the more important countries.

Local Government Areas.— One important consideration is the nature of the local government areas. In some countries, there are comparatively large districts, often called provinces, which in modern times are historical divisions, in some cases representing formerly independent states. Such are the provinces of Prussia and Italy. In other countries, the older provinces have disappeared, and more recently established districts, generally smaller than the provinces, have been created, as the "departments" of France. With these may be compared the counties of England. Both of these classes of districts include both urban and rural territory.

In addition to such districts, in most countries there are now somewhat smaller local government areas,— such as the "circles" in Germany, the "arrondisements" in France and the "rural districts" of England; and in most of the American States, counties are comparable in size and importance with such districts of the second order in European countries. Most of the districts of this class include both urban and rural territory; but with the development of urban population during the last century, there are now distinctively urban districts of this type, and the district government is often combined with that of the city.

Still further, there are in all countries local communities of smaller area, ranging from rural villages, parishes or towns, to large metropolitan cities. In some countries, as in Germany and England, there is an important legal distinction between rural towns or parishes and urban municipalities, such as cities and boroughs. In France both rural and urban communities are organized as communes. In the United States there are wide variations between the different States. In the north Atlantic States, the term city is limited to places of over 10,000 or 12,000; in the Southern and Western States the minimum population for cities is lower,— from 5,000 in Ohio to 300 in Kansas. Smaller semi-urban districts are classed as villages or boroughs; while in New England the town government usually includes that of the villages.

In addition there is a great variety of special districts for particular purposes, overlapping the other areas. These are frequently organized as administrative subdivisions for the central government; but in England and the United States many such districts have also been established with locally elected authorities,— such as poor law, port and burial districts in England; and school, drainage, sanitary and many other districts in the American States. The recent tendency in England is to eliminate such special districts; and to carry on public functions, as on the continent of Europe, by the more general local authorities, sometimes uniting several such districts for particular purposes.

Centralization and Decentralization.— In the organization of government one of the most important factors is the relative degree of central control and local autonomy as to the work done by local officials. In this respect both history and present systems show a wide range of variation from extreme centralization to an extensive field of local home rule.

As Rome extended its dominion, the former city-states which it conquered were allowed to retain a large measure of self-government. But beginning with a centralized system of military and tax administration, the sphere of central control was gradually enlarged; and as ultimately organized in the time of Diocletian the whole system of government became thoroughly centralized, with the officials of the prætorian præfectures, the provinces and the municipalities appointed by and subject to the control of the higher authorities.

With the decline and breakup of the Roman Empire, the highly centralized system disappeared; and the feudal system which prevailed through western Europe during the Middle Ages was largely one of decentralized local government, where power was largely in the hands of the feudal lords. This system was modified by the development of cities, which also gained a large measure of local autonomy, exercised mainly by the merchant classes, and leading to another form of local oligarchy. Beginning in the latter part of the mediæval period, principalities and kingdoms arose, the rulers of which steadily gained power, reducing the autonomy of the local communities and minor nobles on the one hand, and at the same time weakening the central authority of the mediæval empire and the Roman Church.

Local institutions in Anglo-Saxon England were highly decentralized, in the hands of shire or county courts, composed of representatives of the hundreds and presided over by the sheriffs, appointed by the Crown. After the Norman Conquest the power of the sheriffs increased; and the central control of the Crown was still more strengthened by the development of law courts held by judges appointed by the Crown. But the movement toward complete centralization was affected by the development of justices of the peace and Parliament. The unsalaried justices were appointed from property-owners and were thus more independent and were also not subject to active central control. In Parliament, the more important local districts — counties and boroughs — as well as the local nobility, were represented. The result was a system of legislative rather than executive centralization, with the control over both central and local government in the hands of the well-to-do classes.

During the 19th century, the English system of local government was extensively altered. It has been made much more democratic by the establishment of popularly elected local councils. The scope of local functions has been radically enlarged. At the same time, the local authorities have been made subject to a large degree of central administrative control, exercised by the Local Government Board and other departments of the central government. The fundamental legal basis of ultimate legislative centralization in the hands of Parliament remains; but Parliament has been reorganized on a more democratic basis, and with a more equitable representation of the local districts.

On the continent of Europe the tendencies toward centralization in each country continued to the end of the 18th century. These were most marked in France, where, after a brief interruption in the early years of the Revolution, a new and completely centralized system was established under Napoleon I, with prefects, sub-prefects, mayors and local councils, all appointed by and subject to the control of the central government. Since 1830, however, there has been some relaxation. Locally elected councils have been established; and the municipal councils elect the mayors of the communes, except in Paris. But the system of local government remains more highly centralized in form than in any other important country.

In Italy, Spain, Holland and Belgium the local government systems have been largely influenced by the French system; but with somewhat more local autonomy.

German local institutions have also been reorganized during the 19th century; and the recent system showed the influence of both French and English factors, as well as distinctly German elements. The general tendency has been toward an increase of local autonomy; and the expansion of local functions has been much more marked than in France and in some respects more than in England. Administrative control by the central governments of the several states over the local authorities has been less intensively organized than in France, but more highly developed than in England. On the other hand, with the comparative weakness of popular control and the importance of professional officials, the local government has operated much as a highly centralized system.

What will be the permanent result of the changes following the great war cannot be definitely predicted.

Local government as developed in the American colonies followed the main lines of the English system of the 17th century; and until the middle of the 19th century the tendencies toward legislative centralization and administrative decentralization continued to develop. Since about 1850 there has been some movement in the opposite direction. The power of the State legislatures has been limited to some extent; and State officials have been established with supervision over local authorities and in some fields with powers of direct administration.

Each State has control over its own system of local government, which is determined in part by the State constitution and more largely by detailed statutory legislation, with no clear distinction between State laws of general interest and those dealing with local affairs. At the same time these laws are largely administered by locally elected officials; and many State constitutions provide for the local election of county officers. Legislative control is also limited in many States by constitutional provisions prohibiting and restricting special legislation; and in some of the Central and Western States cities have authority to adopt their own charters of local government. On the other hand, there are now State officials with powers of administrative supervision over local officers in the fields of education, charities, public health, public utilities and finances; and in these and other lines there has developed a considerable amount of direct State administration. These tendencies toward a more centralized administration are, however, still far behind the conditions in continental Europe, or even in England. There is need for further changes so as to develop a more coherent policy of local government.

Local Organization.— In the organization of local institutions it is important to note: (1) The degree of concentration or division of authority in the several local districts; and (2) the professional or non-professional character of local officials.

Local powers in England are almost uniformly vested in elected councils of unpaid members, such as the county council, the borough council and the urban or rural district council. These councils act largely by means of committees of their own members; and the chairman or mayor is merely the presiding officer. Subordinate to the council are permanent expert officials.

In France there is also a series of popularly elected councils in each local district, with financial and local legislative powers. But the executive authority of each district is vested in a single official — as the appointed prefects of the departments, and the mayors of communes elected by the communal councils. The prefects are a class of professional officials; but the mayors are not usually trained. Under these are subordinate experts for the various branches of administration.

German local organization is more complicated; it includes elected local councils and trained professional experts; but the latter have more independent authority and larger influence than in France or England. The mayors of cities, as well as the chief executive officers in the provinces, districts and circles, are professional officers. Much use is made of administrative boards, composed of professional and non-professional members, in contrast with the single-headed executive authority in France.

In the United States there is a wide variety in the forms of local organization. County government is divided between a series of elected officials, with no common superior, and an elected board of commissioners or supervisors — the latter in most States a small body elected at large, but in some States a larger body elected by towns or districts. New England town government has a similar unconcentrated organization; but in some of the Central States the town supervisor or trustee is the head officer. Cities formerly had a similarly loosely organized government; but in recent years there have been marked tendencies toward a more concentrated organization. In many places this has been brought about by increasing the power of the elected mayor; in many others by placing the city government in charge of a small commission of three or five elected members; while the latest plan provides for the election of a small council, which chooses a city manager as the chief executive officer. Civil service laws have also secured a better trained and more permanent subordinate service.

The method of electing a large number of officials by popular vote for short terms has hindered the development of a professional expert service; and as a result local administration has been extremely inefficient. The more recent tendencies in city government toward a more concentrated organization have been accompanied by an increase in the class of trained officials. But local government in the United States remains more loosely organized and with a larger proportion of untrained officials than in any other of the countries here noted.

Popular Control.— The general tendency in all governments since the end of the 18th century has been toward an increase of popular control by the extension of the elective franchise. This has reached its maximum in the United States, where the prevailing system is one of the general manhood suffrage, with short residence qualifications. In a considerable number of States women also have the right to vote — and in some States where women do not vote in all elections, they may do so in some local elections. In the Southern States, however, the negro vote has been practically eliminated. But the numerous elections and long lists of elective officials have hindered the effective exercise of popular control, and the real power is often in the hands of party and other political organizations.

France also has manhood suffrage in local elections. In England local councils are elected under a widely extended suffrage, including women but excluding the floating population. In Germany the suffrage for local elections has been more restricted: in Prussia all taxpayers could vote; but the voters were grouped in classes based on the amount of taxes paid, and this placed the effective control in the hands of the well-to-do classes.

Summary.— To sum up, local government in the United States is the most democratic in form, and the most loosely organized, makes the least use of trained officials and has the maximum of administrative decentralization; but is subject to a large degree of State legislative control. English government is democratic and has a more concentrated organization, more trained officials and a considerable degree of central administrative supervision. In France, local government is democratic, but has a highly concentrated executive organization, expert officials and the highest degree of administrative centralization. The Prussian system has had the least popular control of any important country, a complicated organization, a large degree of central administrative control and the most highly trained, expert professional officials.

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LOCAL OPTION. The phrase local option may be applied to a great variety of matters which may be determined by the action of local communities. In the broadest sense, it includes all powers of local government, as distinguished from mandatory duties. More commonly the term is used with reference to permissive or adoptive laws dealing with specific subjects — such as the choice between the county and township forms of local government, the alteration of boundaries and the conduct of elections. Before January 1920 when national prohibition was to take effect, the term was commonly used with reference to the local prohibition or license of the sale of intoxicating liquors, usually by popular vote.

In 1829 the selectmen of each town in Maine were authorized to decide whether or not to permit the sale of liquor; but this method soon ceased to have statutory warrant. In 1868 Massachusetts recognized the local option principle in its liquor laws; and in 1881 definitely established the local option system. Other States gradually provided for some method of local prohibition of liquor selling; and by 1900 laws for this purpose had been passed by 37 States. Later a number of local option States adopted State prohibition, while other States provided for some form of local option. In 1916 there were 19 States where the sale of liquor was prohibited; 26 others had local option laws, applying to a variety of districts; while in the three remaining States (Pennsylvania, New Jersey and Nevada) methods had been found to exclude the sale of liquor from certain limited areas.

In three States — Maryland, Michigan and Montana — the local option laws on the sale of liquor applied to counties. In eight other States, the vote could be taken by counties or by smaller districts; and in such cases smaller districts might usually be voted "dry" although the county as a whole was "wet." This group of States included Florida, Kentucky, Louisiana, Minnesota, Missouri, New Mexico, Texas and Utah. In 15 other States the vote was taken by cities, villages, towns or county districts. This group included the New England States (except prohibition Maine), New York, Delaware, Ohio, Indiana, Illinois, Wisconsin, Nebraska, South Dakota, Wyoming and California. In New York the option of prohibiting the sale of liquors was given only to towns and not to cities. In Illinois a township which included a city might exclude saloons from the whole area, although the city gave a "wet" majority. In a few States, as Ohio and Minnesota, districts within a city might exclude saloons.

Local option elections on the sale of liquors in most of the States were held on petition of the electors — the percentage required ranging from 10 per cent in Connecticut to 40 per cent in Ohio, with 25 per cent as the prevailing ratio. The question might be resubmitted at intervals, varying from one to four years in the different States, two years being the most common period. In Massachusetts, New Hampshire and Vermont the question of license or no license was voted on without petition at each town election. South Dakota was all considered "dry" until a local district voted "wet"; and a new election had to be held each year to continue saloons. In Wyoming, the municipal councils might refuse to license saloons.

Under local option laws and State prohibition 80 per cent of the land area of the United States with 54 per cent of the population had no licensed saloons. Of the local option States, 12 had more than half the population in "dry" territory; and 14 had less than half. The dry regions were mainly in States with a large rural population and also the States where the proportion of native population was largest; while the States with a large urban and foreign population were predominantly "wet." The most important instances where urban districts excluded saloons under local option laws were Cambridge and other suburban cities near Boston; while a similar situation existed in the no license districts within the city of Chicago.

Notwithstanding the large increase of no-license territory, there was a steady increase in the per capita consumption of intoxicating liquors in the United States. From 1840, the per capita consumption had multiplied five-fold; but the greater part of this had been in the milder fermented liquors; and the rate of increase had been less during the last 25 years. In the 10 years from 1903 to 1913, while population increased about 20 per cent, the consumption of distilled spirits increased about 25 per cent and of malt liquors about 40 per cent. During the same period, the production of distilled spirits increased about 70 per cent. Part of the increase in distilled spirits was probably due to the larger use of alcohol in the arts. See SCIENCE; LIQUOR TRAFFIC.

Bibliography.— 'Local Option in the United States' in the *National Municipal Review*, October 1916; Anti-Saloon League *Year Book;* U. S. Brewers' Association *Year Book;* Rowntree and Sherwell 'Public Control of the Liquor Traffic' (1903).

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LOCALITY, Perception of. Our sensations are associated with positions in space. That this is the case with vision and joint sensations is obvious, while in all the other senses a stimulus is referred to the approximate spatial position of the organ that perceives it, and is possibly further referred to some place in space from which it is believed to arise. The senses with the most direct spatial reference appear to be vision, the sensations of the skin, and those of the joints. The spatial relations of two objects presented to the eye are as immediately given as their relations of color-intensity or color-quality. In the same way, the location of an object on the skin or the position of a joint are primitive attributes of the experience of the object. However, the visual, tactile and articular spatial worlds are per se of a bi-dimensional character. The relations of space in the third dimension are not directly given in experience, but are the result of the synthesis of a large number of different factors. In the case of vision, these factors are the parallax of the visual objects with reference to the interocular distance, the experiences of the muscles of the eyeballs as they focus the eyes and regulate their degree of convergence and such phenomena of geometrical and atmospheric perspective as have been given by habit a three-dimensional interpretation. The cutaneous senses acquire their three-dimensional interpretation through association with visual experiences and experiences of joints, and through the complex of cutaneous sensations resulting when two parts of the integument are brought into contact with one another. The sensations of a single joint are necessarily uni-dimensional or bi-dimensional, as the joint cannot have more than two degrees of freedom, but the combined sensations of two adjacent joints furnish a three-dimensional manifold, corresponding to the three degrees of freedom of a point at the end of a doubly jointed rod. The three-dimensional worlds of sight, touch and joint-position formed in the manner thus indicated are amalgamated into a single space by that intimate association of their phenomena which is impressed on us from the very start of our experience, and which is possibly even prior to our consciousness of this association. An important theory in this connection is that due to Lotze, and known as the theory of local signs. According to this view, each cutaneous sensation carries with it a peculiar qualitative distinction that is always associated with the point of its origin. As it appears impossible, however, to discover any qualitative characteristic peculiar to each place on the skin, the local sign of a cutaneous sensation is probably just that visual localization that accompanies it.

It is altogether probable that hearing and smell, at any rate, have no distinctly spatial attribute, and that the localization of sounds and scents is due to the association of certain non-spatial characters on their part with the sight-touch spatial system. In the case of sound the chief factor is the relative intensity of the sensations in the two ears, as is shown by the poorness of localization in cases where hearing of one ear is lost, and by the practical impossibility of determining the source of a sound in the median plane. The quality and absolute intensity of the sound are also indices of its source. The quality is somewhat dependent on the direction from which the sound reaches the pinna, and so enables a certain degree of localization in hearing with a single ear. In the case of smell, localization depends on the relation between the position of the head and the intensity of the sensation.

The accuracy of localization can be measured in two ways. The first is to determine the lower limen (see LIMINA) of the interval between two stimuli; the second is to indicate the absolute position of a stimuli, and measure the average error of the localization. While the former method often indicates a greater sensitivity than the latter, the relation between the acuity of absolute and relative discrimination of locality varies in the different senses. In sight relative discrimination preponderates, and two points subtending an angle of one minute or a retinal distance of .004 millimetre can be distinguished. A binocular parallax of five seconds suffices to give an impression of depth. In the case of the pressure sense, the average absolute error of localization is 5 to 10 millimetres on the wrist. The discrimination limen for the tactile senses is not clearly defined, and the sensation from pressure at two points goes through several stages of elongation before it is distinctly double. If the pressure is applied at pressure spots, the two point limen assumes a much smaller value than otherwise, and is about 0.3 millimetre on the back of the hand, 0.5 millimetre on the forehead, .08 millimetre on the chest, and 4 millimetres on the back. The corresponding values for the cold sense are 2, 0.8, 2, and 1.5 millimetres; for the sense of warmth, 3, 4, 4, and 4 millimetres respectively. The least noticeable movement of the hip-joint is 0.5 degree; for the ankle, 1 degree. The localization of organic sensations is highly irregular, and exhibits many anomalies. (See LIMINA; SPACE; VISION). Consult Külpe, O., 'Outlines of Psychology' (tr. New York 1909); Ladd, G. T., and Woodworth, R. S., 'Elements of Physiological Psychology' (New York 1911); Lotze, R. H., 'Medizinische Psychologie' (Leipzig 1852); Titchener, E. B., 'Text-Book of Psychology' (New York 1910); Wundt, W., 'Grundzüge der physiologischen Psyychologie' (6th ed., Leipzig 1908–11).

LOCARNO, lō-kär'nō, Switzerland, town in the canton of Ticino, on Lake Maggiore at the embouchure of the Maggia, 14 miles southwest of Bellinzona. It is only 680 feet above sea-level and is said to be the lowest part of Switzerland. Nearby is the sanctuary of the Madonna del Sasso, frequented annually by great numbers of pilgrims. Brushes and candles are the only industries of importance. The Milanese lost Locarno to the Swiss in 1512; in 1798 it was included in the canton of Lugano in the Helvetic republic. In 1555 its Protestant inhabitants were driven out and, going to Zurich, founded the silk industry there. Pop. 5,630, mostly Italians.

LOCH, lŏk, **Henry Brougham Loch,** FIRST BARON. British colonial administrator: b. 23

May 1827; d. London, 20 June 1900. He joined the navy in 1840, but in 1842 entered the service of the East India Company, being commissioned in the Bengal Light Cavalry. He served in the Sutlej campaign. In the Crimean War he commanded a brigade of irregular Bulgarian cavalry and in 1857 was made attaché to Lord Elgin on a mission to China. In 1858 he brought home the treaty of Yedo. In 1860 he went to China a second time as secretary of embassy. During the negotiations for peace at Tungchow he was made prisoner, taken to Pekin, where he and Parker endured all the horrors of a Chinese prison. He was released within a short time but his health was greatly impaired. Loch was knighted on his return to England and in 1863 was made lieutenant-governor of the Isle of Man. From 1884 to 1889 he was governor of Victoria and in the latter year became governor of Cape Colony and high commissioner of South Africa. In South Africa Loch supported the policy of Cecil Rhodes and several times opposed President Kruger in the latter's attempts to prevent British expansion to the north. In 1895 Loch returned to England and was raised to the peerage. At the outbreak of the Boer War he raised and equipped the body of men known as "Loch's Horse."

LOCH LOMOND. See LOMOND, LOCH.

LOCHES, lōsh, France, town and capital of an arrondissement in the department of Indre-et-Loire, situated on the Indre, 30 miles southeast of Tours. It contains an ancient castle of the Anjou family with many interesting mediæval remains. Here, also, are the oratory of Anne de Bretagne and the tomb of Agnes Sorel. It has also a fine town hall, the church of Saint Ours, a communal and training college. Leather, liqueurs and textiles are manufactured. The town grew up about the monastery founded here in 500 by Saint Ours. For a long time after 1250 the castle was a residence of the kings of France. Pop. 3,940.

LOCHINVAR, lŏk'ĭn-var', the hero of a famous ballad in Sir Walter Scott's 'Marmion.'

LOCHLEVEN. See LEVEN, LOCH.

LOCHNER, lŏch'nĕr, **Stephen,** German painter: b. Meersburg, on Lake Constance, date unknown; d. 1451. Very little is known of his life or of his artistic education. About 1426 he removed to Cologne where he soon became prominent. In 1447 and in 1450 he was councilor to the Painters' Guild of that city. Lochner's greatest work is the triptych called the Kölner Dombild (lit. Cologne Cathedral Painting). The centre panel is devoted to 'The Adoration of the Magi,' the right contains, 'Saint Ursula and her Handmaids,' and the left 'Saint Gereon and the Theban Legion.' It is the greatest work of the Cologne school and one of the finest in Germany. Other works of Lochner are 'The Madonna with Violets,' in the Archepiscopal Museum, Cologne, 'Christ and Saints,' in the Nuremberg Museum; 'Madonna in the Rose Arbor,' in the Wallraf-Richartz Museum, Cologne, and 'The Presentation in the Temple,' at Darmstadt. Lochner was an excellent colorist but a mediocre draftsman. Consult Aldenhoven, Carl, 'Geschichte der kölner Malerschule' (Lübeck 1902) and Escherich, Mela, 'Die Schule von Köln' (Strassburg 1907).

LOCK, a mechanical appliance used for fastening doors, chests, etc., generally opened by a key; or more broadly speaking, a lock is a *bolt* guarded by an *obstacle,* and controlled by a *key.* The *bolt* may be pivoted or rotary, but usually slides; the *key* generally rotates, but may act by sliding or pushing; the *obstacle,* which in order to operate the bolt must be overcome by the key, may be of the *warded* (fixed) or of the *tumbler* (movable) types.

History.— The history of the art of the locksmith is probably as old as the history of civilization, and references to it are found in the early literature of every nation. Wood was undoubtedly the first material used in construction, but the Egyptians appear to have, at an early date, employed brass and iron also. The Hebrews and Greeks used crooked keys, with ivory or wooden handles, for the purpose of bolting or unbolting doors. Some of the modern Greeks still employ the primitive method of closing doors from the inside by a wooden or metallic bar, attached to the door by means of leather strings or small iron chains; wood or iron keys, made in the shape of hooks, were inserted through a hole in the door and by turning lifted up the bar on the inside. The similarity of these primitive locks rendered access to the house easy and soon led to an improvement upon the method, resulting in the so-called Lacedæmonian lock. This too was improved, but of the workings of this lock no description has come down to us.

Among the nations of antiquity lock-making made little progress in advance of what had been done by the Egyptians. Even the Romans, who excelled the other nations of the world in iron-work, used very simple locks, resembling those of the modern Greek. The *tumbler* lock was next in succession, and was probably first invented and used by the Chinese. In this lock a lever or slide entered a notch in the bolt, which could not be moved till the tumbler was lifted by the key. The *warded* lock, used by the Etruscans, was the next form of lock which came into general use. While the Roman locks belong to the same description, they were distinctly different. In locking and unlocking the keys did not make a complete revolution and consequently were identical with the spring locks of modern days. After the downfall of the Roman Empire, lock-making took on an unprecedented impulse, owing to the increased danger of robbery, and human ingenuity was taxed to the limit to provide means for the safe-keeping of valuables. About 1650 a fourth type of lock, the *letter* or *dial* lock, was invented by M. Regnier, director of the Musée d'Artillerie at Paris, and these four types form the basis for the majority of our modern locks.

Locks were first manufactured in England during the reign of Alfred (A.D. 871–901), but no substantial improvement in their construction was made till the latter part of the 18th century. These improved locks were the Barron, first patented in 1778, the Bramah lock, patented in 1784; these were followed in 1818 by the Chubb, and later by the American

Parautopic lock of Day and Newell. Of those then manufactured, this latter lock became the most generally used for safes because it presented the least possibility of being picked, but this lock finally succumbed to the skill of Linas Yale, Jr., an American inventor (b. 1821; d. 1868). Yale had for a number of years been interested in and had patented locks of diverse types and ingenious construction. The modern combination lock was then unknown, and Yale's earlier inventions related to locks operated by keys, but great security was obtained by making the «bit» of the key changeable at will and also detachable from the handle, so that, as the latter was rotated in the lock, the former was detached and carried away from the key-hole to a remote part of the lock, and there brought into contact with the tumblers to set them in position to permit the bolt to move, the continued rotation of the key handle then operating the bolt and returning the «bit» to the key-hole for removal. Yale then perfected the *dial* lock, the improved form of which is now in universal use in America for safes and vaults, and which, as now made, is proof against picking by any methods thus far discovered.

Mr. Yale's most important invention, brought out in 1860 to 1864, was the key lock universally known as the *Yale* lock, the United States patents for which were issued on 29 Jan. 1861 and 27 June 1865. This combination of a flat key and revolving «plug» has almost entirely superseded the crude and bulky lock, of indifferent security and inferior workmanship, which was opened by a round key, and the introduction of the Yale or cylinder type completely revolutionized the art of lock-making in America.

Yale's inventions led to the dial lock of James Sargent, but as the user of both of these, the Yale and the Sargent, could be coerced to open them, and were indeed picked by experts, the inventors turned their attention to making the only lock which is absolutely unassailable — the *time-lock*. This was first suggested in 1831 by an Englishman, William Rutherford; in 1857 Holbrook and Fish of the United States devised another, but the first successful time-locks put on the market were the Sargent and Yale time-locks, brought out in 1875, and followed later by the Pillard, the Homes, the Hall and others.

Warded Locks.— In the majority of this class there is a «back spring» or dog, the feeling of which, when using the key, resembles that of a tumbler, but which adds nothing to the security.

Lever Tumbler Locks.— These locks may contain several tumblers, the number of key changes usually being limited to from 12 to 24 and possibly 72, while in a good three-tumbler lock of this style as many as from 200 to 500 key-changes are possible. Round, barrel and flat keys are used.

Cylinder and «Pin-Tumbler» Locks.— The former term applies to locks in which the pin tumbler is contained in a cylinder separate from the lock case; the latter is applied to those wherein the pin tumblers are contained in the lock itself.

Master-Keyed Locks.— A series of locks is said to be «master-keyed» when so constructed that each lock can be operated by its own key, which fits no other lock of the series, and also by another key which will operate every lock in the entire series. Warded locks are master-keyed by means of a «skeleton» key, with the bit cut away sufficiently to avoid all the wards in all of the locks of the series. Lever-tumbler locks are master-keyed in three ways, either by providing two «gatings» on each tumbler, one of which is brought in line with the corresponding «fence» or post on the bolt by the change-key and the other by the master-key; by providing a «lifter,» which, when actuated by the master-key, moves the tumblers in the same manner as does the change-key when the latter acts directly on the tumblers; or by providing a set of secondary levers, which, when operated by the master-key, move the primary tumblers in the same manner as the change-key which acts on them directly. Pin-tumbler locks are master-keyed by cutting each pin in two places, or by encircling the plug (which contains the key-way) with a larger annular plug, thus providing two points at which each tumbler may be set to permit the plug to rotate, and utilizing one set of these points for the change-key and the other set for the master-key.

Time of Chronometer Locks.— In these the mechanism is actuated by clock-work, and is used, in connection with the heavy bolt work of a safe door, to prevent the unlocking of the latter except upon the hour at which the clock is set. There are generally three chronometer movements, each of which will of itself actuate the lock, so that should one or two be disabled or inoperative, the other will open the door at the time indicated. In connection with the time lock an automatic bolt operating device is often used.

Dial or Combination Locks.— These consist essentially of a bolting mechanism guarded by a set of changeable tumblers or wheels, and actuated by a spindle passing through the door, provided on the outer end with a graduated dial, by rotating which in a certain manner the tumblers can be set and the lock be operated.

Lock-Making.— The first locks made in this country naturally were patterned after those made in Europe, but whereas the European artisan used wrought metal in construction, the American manufacturers soon turned from this and employed cast metal. This change, together with the introduction of vastly improved machinery, soon reduced the cost of production, so that now locks of the best type can be purchased at a merely nominal cost, and while, for a few years after 1870, the sharp competition among manufacturers tended to reduce the quality of the production, the mechanical advancement since that time has been marked and at the present time the highest grade of workmanship and mechanical skill is manifest in the articles on the American market. The chief centres of lock-making are in Eastern Pennsylvania and Connecticut. Consult Fox-Pitt-Rivers, 'On the Development and Distribution of Primitive Locks and Keys' (London 1883); F. E. Kidder, section on Locks in 'Building Construction' (part 2, pp. 580-603, New York 1913); and H. R. Towne, 'Locks and Hardware' (ib. 1904).

LOCK HAVEN, Pa., city, county-seat of Clinton County; on the Susquehanna River and on the New York Central and the Pennsylvania railroads; about 68 miles northwest of Harrisburg. The first settlement was made in 1769 and, in 1833, it was incorporated as a town. In 1844 it was made a borough, and in 1870 received its city charter. It is situated in an agricultural, manufacturing and lumbering region. Its chief industrial establishments are lumber and planing mills, tanneries, cigar factory, foundries, fire-brick works, silk mills, breweries, paper mill, woven wire works, steam laundries, dye and chemical works and furniture factory. The State Central Normal School is situated here and there is a new high school. Some of the prominent buildings are the courthouse, a hospital and several fine churches. The city has a circulating library containing about 6,000 volumes. The waterworks are the property of the municipality. Lock Haven has adopted the commission form of government. Pop. 7,772.

LOCKE, lŏk, **David Ross** («PETROLEUM V. NASBY»), American humorist and satirist: b. Vestal, Broome County, N. Y., 20 Sept. 1833; d. Toledo, Ohio, 15 Feb. 1888. He learned the trade of printer and after being connected with several newspapers was editor and owner of the Toledo *Blade* in 1865, and very soon became popular as a humorous writer and later as a lecturer. He began his «Nasby» letters in the Findlay *Jeffersonian* in 1860 and continued them throughout the Civil War. They exercised much influence in molding popular opinion, upholding as they did the policy of the Lincoln administration. In later years the satire of the letters, which still continued to appear, was aimed at President Johnson and his peculiar methods. They were collected and published in book form under the titles 'Divers Views, Opinions and Prophecies of Yours Truly' (1865); 'Swingin' Round the Cirkle' (1866); 'Ekkoes from Kentucky' (1867); 'The Struggles — Social, Financial and Political — of P. V. Nasby' (1872). He also published 'Hannah Jane'; 'The Moral History of America's Life Struggle'; 'The Morals of Abou Ben Adhem'; 'A Paper City' (1878), and 'Nasby in Exile' (1882).

LOCKE, John, English philosopher: b. Wrington, Somerset, 29 Aug. 1632; d. Oates, Essex, 28 Oct. 1704. He was the son of an attorney who became a captain in the Parliamentary army. Locke was educated at Westminster School and at Christ Church, Oxford, where he was graduated and took his bachelor's degree in 1656; two years later took the degree of M.A. and entered upon the study of medicine. He lectured at Oxford (1660–64) on Greek, rhetoric and philosophy, and during this period became interested in experimental physics, especially chemistry and meteorology, and in metaphysics showed a preference for studying Descartes, although his own philosophy powerfully antagonizes that of the French master. Theology and politics, including diplomacy, also engaged his attention. At Oxford before 1666 he is said to have practised medicine, in which, however, he was never graduated. As secretary to Sir Walter Vane, British envoy, he went in 1665 to Cleves, Prussia, returning to Oxford in the following year, during which time he made the acquaintance of Lord Ashley, afterward 1st earl of Shaftesbury, became his family physician and secretary, under his patronage held various offices, and in 1682 accompanied him into exile to Holland. Locke continued to reside abroad until 1689, when, after Revolution had been accomplished, he returned to England to become commissioner of appeals. His association with Lord Ashley, between whom and himself there was close intellectual sympathy, was stimulating to his genius, and it was in Ashley's house that Locke first planned the 'Essay on the Human Understanding.' Fully elaborating this work during his voluntary exile, he published it in complete form in 1690, with a dedication to the earl of Pembroke, whose acquaintance he had made at Montpellier many years before. The 'Essay,' which had largely occupied him for almost 20 years, met with much criticism in England, being particularly opposed at Oxford; but on the Continent it brought him great celebrity, and was translated into French and Latin and later into other languages. For the copyright of the first edition he received but £30, and although he had previously published two works this was the first to bear the author's name. In 1696 Locke was made a commissioner of trade and plantations, but in a few years became incapacitated and retired, and from 1700 until his death lived with his friend, Sir F. Masham, at Oates. Meanwhile being drawn into the violent controversies over the essay which arose among different sects and schools, he had sturdily maintained his ground in a style of epistolary polemics which still possesses an academic interest.

As a philosopher Locke's place is usually fixed at the head of the English Sensational School, although this classification by no means does justice to his many-sidedness as a thinker, and the term «sensationalism,» with its ordinary connotations, is wholly inadequate for a correct representation either of his speculative inquiries or of those still less definable meditations which led him profoundly to search the realms of ethics and of spiritual laws, in an endeavor to assign the relations and functions of these in the world of practical politics and that of instituted religion. Of that sensationalist school of which he is reputed to have been founder, it has been said with much pertinence that its ultimate conclusions are such as «his calm and pious mind would have indignantly repudiated.» The 'Essay on the Human Understanding' holds a permanent place among the greater works of philosophy, in the history of which, however, Locke's method may be superseded, and although his main doctrine be exploded, the book retains its importance as an epoch-marking achievement. It seeks the primal sources and the scope of human knowledge, denying the existence of innate ideas, presenting the mind as a sheet of white paper prepared to be written upon by experience, which alone supplies the knowledge there impressed, and tracing the sources of all ideas to what he calls sensation and reflection. This doctrine of the *tabula rasa* or white paper found a vigorous controverter in Leibnitz (q.v.). The opposition which Locke thus represented between all intuitional and experiential philosophies still remains a central point of dispute among thinkers of various schools, but he was a forerunner in psychology, as he was also in the advocacy of civil and religious liberty, for which he suffered persecution and betook himself to exile.

Upon questions of government Locke was in the main a follower of Hobbes (q.v.) in so far as the latter regarded governmental authority as something delegated by the subjects for the creation of the state, through a compact which carried in itself the principle of obligation. But he went far beyond Hobbes in the application of his views to the concrete affairs of politics. In 1689 a constitution for the Carolina colonists was drafted by him, and was an evidence of his concern to put political philosophy to practical service. (See Essay concerning the Human Understanding). Besides the 'Essay,' his works include letters 'Concerning Toleration' (1689); 'Two Treatises on Government' (1690); 'Some Thoughts Concerning Education' (1693); 'The Reasonableness of Christianity'; and a little book 'On the Conduct of the Understanding,' posthumously published. Frazer's edition of the 'Essay' (1894) is the most desirable. His philosophical writings have been published in various editions, Saint John's (1854 et seq.) being one of the most useful. Consult King, 'The Life of John Locke' (1829); Fox Bourne, 'The Life of John Locke' (1876); Fowler, 'John Locke' (1880); Frazer, 'Locke' (1890); Russell, 'The Philosophy of Locke' (1891); and Ueberweg-Heinze, 'Grundriss der Geschichte der Philosophie' (8th ed., 1896), where a more extended bibliography is to be found.

LOCKE, William John, English novelist: b. 20 March 1863. He was educated at Queen's Royal College, Trinidad, and Cambridge University, and was secretary of the Royal Institute of British Architects, 1897–1907. His fictions include 'At the Gate of Samaria' (1895); 'The Demagogue and Lady Phayre' (1896); 'A Study in Shadows' (1896); 'Derelicts' (1897); 'Idols' (1898); 'The White Dove' (1900); 'The Glory of Clementina' (1911); 'The Joyless Adventures of Aristide Pujol' (1912); 'Stella Maris' (1913); 'The Fortunate Youth' (1914); 'Jaffery' (1915). These have been reissued in the United States. He has also written several plays.

LOCKER-LAMPSON, Frederick, English lyric poet: b. Greenwich, 29 May 1821; d. Rowfaul, England, 30 May 1895. He wrote a volume of «society verses,» 'London Lyrics' (1857), greatly admired for their grace and finish; edited an anthology, 'Lyra Elegantiarum' (1867); and arranged a collection of miscellanies entitled 'Patchwork' (1879). In 1874 he married for his second wife the daughter of Sir Curtis Lampson and took her name in addition to his own. Consult 'My Confidences,' his autobiography (1896).

LOCKHART, lŏk'ărt, **John Gibson,** Scottish editor and biographer: b. Cambusnethan, Lanarkshire, 14 July 1794; d. Abbotsford, 25 Nov. 1854. He was graduated at Glasgow and Balliol College, Oxford, and became a member of the Scottish bar in 1817. He never practised as an advocate, but devoted his time to literary pursuits. In 1817, with Professor Wilson, he established *Blackwood's Magazine,* a Tory organ, which at the outset created an immense sensation by the ability and keen satire displayed in many of its articles. In 1819 he published 'Peter's Letters to his Kinsfolk,' in which Edinburgh society was keenly satirized. In 1820 Lockhart, who had previously become a favorite with Sir Walter Scott, married his eldest daughter, and much of his future life took its color from this connection. In 1825 he became editor of the *Quarterly Review,* which he conducted with marked ability, and continued in the position till 1853. His translations of 'Spanish Ballads,' originally contributed to *Blackwood,* were collected in 1823. He also published the novel 'Valerius' (1821); 'Reginald Dalton' (1823); 'Adam Blair' (1822); and 'Matthew Wald' (1824); 'Life of Robert Burns' (1828); 'Life of Sir Walter Scott' 1836–38. This last is the most celebrated of his works, and takes its place as perhaps, after Boswell's 'Life of Johnson,' the most perfect of English biographies. His earnings from this work he surrendered to Scott's creditors. Lockhart, for his steady attachment and important services to the Conservative party, was rewarded in 1843, with the appointment of auditor of the duchy of Lancaster. His later life was clouded by domestic bereavement. His little invalid son was the Hugh Little John of Scott's 'Tales of a Grandfather.' He was buried in Dryburgh Abbey, close by Sir Walter Scott. (See Life of Sir Walter Scott). Consult Lang, 'Life of John Gibson Lockhart' (2 vols., New York 1897).

LOCKHART, lŏk'hărt, Texas, town, county-seat of Caldwell County; on the Missouri, Kansas and Texas, and the San Antonio and Arkansas Pass railroads, about 28 miles south of Austin and 140 miles west of Houston. It is situated in a fertile agricultural section in which cotton and live-stock are raised extensively. Some of its industrial establishments are a soap-factory, cotton-gins, cottonseed-oil mill, wagon and carriage factory, cotton-compress, stock-yards, grain-elevators, and lumber-yard. Pop. 2,945.

LOCKJAW. See Tetanus.

LOCKLAND, Ohio, village of Hamilton County, on the Cincinnati, Hamilton and Dayton, the Cincinnati Northern and the Cleveland, Cincinnati, Chicago and Saint Louis railroads, 11 miles north of Cincinnati. Its industrial establishments include cotton factories, paper mills and a roofing establishment. Pop. 3,430.

LOCKOUT, the discharge and keeping out of employment of artisans and laborers by their employers. It is a retaliatory measure adopted by capitalists to resist the demands for shorter hours, more pay, etc., made by their workmen. The workmen may themselves be responsible for a lockout, just as an employer may be responsible for a strike upon the part of his workmen. (See also Strikes and Lockouts), with authorities quoted thereunder.

LOCKPORT, Ill., city in Will County, on the Des Plaines River, the Illinois and Michigan Canal, the Atchison, Topeka and Santa Fé and the Chicago and Alton railroads, 30 miles southwest of Chicago. The city contains Dellwood Park, one of the finest in the State, also oil mills, breakfast food works, a lock factory and great quarries. The water-supply system is municipally owned. Pop. 2,550.

LOCKPORT, N. Y., city, county-seat of Niagara County; on the New York Barge Canal, and on the Erie, the International and the New York Central railroads, 12 miles from

JOHN LOCKE

Lake Ontario, 20 miles east of Niagara Falls, and about 25 miles north by east of Buffalo. It was settled in 1823 by workmen who were employed on the Erie Canal. On 26 March 1829 it was incorporated as a village and became a city 11 April 1865. It is situated in a fertile agricultural region, one of the richest fruit producing sections of the United States; but the extensive water power obtained from the canal has made it an important manufacturing city. The 10 large locks of the canal (now replaced by a tier of two locks operated by electricity), gave its name to the city. The canal passes through a deep cut, an excavation in the solid rock, several miles in length. The New York Central Railroad bridge, 500 feet long, crosses the canal here, at a height of 60 feet above water. There are large sandstone and limestone quarries in the vicinity.

The chief manufactures are pulp and paper, Holly waterworks machinery, wood-work machinery, machinery for flour mills, glass, rolling-mill products, cotton-batting, wagons and carriages, brooms, flour, indurated fibre, crucible steel, aluminum, cotton and woolen goods and creamery products. The products of the manufacturing plants amount annually to over $11,000,000. In addition to the trade in manufactured articles, the city has an extensive trade in the quarry products, and in grain and fruits. Some of the prominent buildings are the Odd Fellows Home, the high school, the new government building and the courthouse. It has several churches and good public and parish schools and two business colleges. It is the seat of Saint Joseph's Academy. There are about 18 miles of paved streets and the total assessed valuation is nearly $14,000,000. The city owns and operates the waterworks. The government is vested in a mayor, elected for two years, and a council of 10 members. Pop. 19,581. Consult Pool, 'Landmarks of Niagara County' (Syracuse 1897).

LOCKROY, lō'krwä', **Etienne Auguste Edouard**, French statesman: b. 1838; d. 22 Nov. 1913. He was a Republican journalist under the Second Empire, he fought with Garibaldi in 1860 and acted as secretary to Ernest Renan in Syria. During the siege of Paris he commanded a battalion and was later one of the signatories to the proclamation for the election of the Commune. He sat in the French Chamber from 1872 to 1906, was minister of commerce and industry 1886–87, of education 1888 and minister of marine 1895–99.

LOCKS, Canal. See CANALS.

LOCKSLEY HALL. Tennyson's 'Locksley Hall' is perhaps not only the best known among his shorter poems but is also one of the most widely read poems in the language. It is a lyrical monologue, 194 lines in length, in eight-stress trochaic couplets. Published in 1842, when the poet himself was only 33 years of age, it is pre-eminently the poem of youth with both its weakness and its strength. Its boy hero is passionate, both in his love and his disappointment; fretful, moody and unsure, unreasonable in his general attitude toward life, yet aglow with humanitarian enthusiasm, on fire with his own splendid vision of the future of the race. He is not an altogether likable and wholesome person, and rather unpleasantly suggests the hectic hero of «Maud,» but he has in him so much of essential and universal youth as to engage the unseen listener of his tale of disappointed love, of passionate upbraiding, of altruistic hopes and dreams. Though the coast setting is that of Lincolnshire, both hero and hall are entirely imaginary. The idea of the setting Tennyson gained from an Arabic poem of the 7th century, which shows a lover, traveling with companions, asking that he be left alone for a time as he stands before the tent of his beloved; the Arabic poem even ends with the coming of a storm, as does 'Locksley Hall.' But Tennyson's subject-matter, replete with allusions to the latest discoveries in electricity, astronomy and engineering, and the latest social movements, is «aggressively modern.» His hero, even in the midst of his complaint, is very much taken up with the events of his time. Yet with all this the poem is highly personal and romantic. The structure is plain, when one notes that the monologue presents the thoughts that pass naturally, and disconnectedly, through the hero's mind as he recalls the past and newly resolves for the future. Remarkable in the light of later events are the famous couplets foretelling aerial commerce and warfare, and those prophesying universal peace by means of a league of nations. The poem is striking even among Tennyson's in the beauty of its figures of speech. One of these, «Love took up the harp of life,» the poet considered his best. Owing to its tropical quality, to the youth that beats through it, and to its spirited verse, «Locksley is one of the most quoted of English poems,» and some of its lines and phrases, such as «In the spring a young man's fancy lightly turns to thoughts of love,» have passed into the common speech.

MARION TUCKER.

LOCKWOOD, Belva Ann Bennett, American lawyer and reformer: b. Royalton, N. Y., 24 Oct. 1830; d. Washington, 19 May 1917. She was graduated from Genesee College, Lima, N. Y., in 1857, and taught school 1857–68. She was married in 1848 to Uriah H. McNall (d. 1853), and in 1868 to Dr. Ezekiel Lockwood. She studied law at Washington, and was admitted to the bar in the District of Columbia after a hard struggle in 1873. Before that time she had secured the passage of a bill giving women employees of the government equal pay for equal work; in 1879 she obtained the passage of a bill permitting women to practise before the United States Supreme Court, and was admitted under this law in the same year. She was engaged in many important law cases, some before the Supreme Court, and was one of the attorneys in the probate of the will of Myra Clarke Gaines. She was active in temperance, peace and women suffrage movements; was secretary of the American branch of the International Peace Bureau; and in 1884 and 1888 was the nominee of the Equal Rights Party for President of the United States. In 1896 she was commissioned by the Secretary of State to represent the United States at the Congress of Charities and Corrections in Geneva, Switzerland; in 1901 she was elected president of the Women's National Press Association. She was for several years interested in the claims of the North Carolina Cherokee Indians, and in 1900 had a bill before Congress to prevent encroachment upon their territory. She was an attorney of record in their case against the government, when they obtained a $5,000,000 judgment. She also prepared an amendment to the Statehood Bill before Congress in 1903, granting suffrage to women in Oklahoma, Arizona and New Mexico.

LOCKWOOD, Henry Hayes, American military officer: b. Kent County, Del., 17 Aug. 1814; d. Washington, D. C., 7 Dec. 1899. In 1836 he was graduated at the United States Military Academy; served with the 2d cavalry in the Seminole War and in 1838 resigned from the army and undertook agriculture in Delaware. He became professor of mathematics in the United States navy in 1841; in 1845 professor of natural philosophy at the Naval Academy, where he was professor of artillery and infantry tactics in 1845–61, and of astronomy and gunnery in 1851–61. He entered the Civil War as colonel of the 1st Delaware infantry, became brigadier-general of volunteers in August 1861. At Gettysburg he commanded a brigade of the 12th corps and in 1863–64 was commander of the middle department. Subsequent to the war he was professor of natural philosophy at the Naval Academy, and in 1871–76 was connected with the Naval Observatory. He published ‘A Manual for Naval Batteries’ (1852) and ‘Exercises in Small Arms and Field Artillery,’ arranged for naval service (1852).

LOCKWOOD, James Booth, American soldier and Arctic explorer: b. Annapolis, Md., 9 Oct. 1852; d. Cape Sabine, 9 April 1884. He entered the army as 2d lieutenant in 1873, and served till 1880 in the West. He volunteered to accompany the Lady Franklin Bay expedition to the Arctic regions in 1881 and was made second in command to Gen. A. W. Greely (q.v.). His fame rests on the discovery of Lockwood Island, in 1882, in lat. 83° 24′ N., the farthest northern point of land or sea up to that time. He was one of the victims in the Cape Sabine tragedy in the winter of 1883–84. His body was brought to the United States and interred in the grounds of the Naval Academy. Consult Lanman, ‘Farthest North’ (1885).

LOCKWOOD, Wilton, American painter: b. Wilton, Conn., 12 Sept. 1861; d. 21 March 1914. In New York he studied under La Farge and subsequently spent 10 years in Paris. In 1904 his works attracted general attention in Europe and the following year an exhibition of his work in Boston was a great success. His best known works are his portrait of La Farge, in the Boston Art Museum; ‘The Violinist’ in Mr. Carnegie's residence at Skibo; ‘Frank Seabury’; ‘A. J. Cassatt’; ‘Grover Cleveland’; ‘Jerome Wheelock in the Worcester Museum’; ‘Justice Holmes.’ Outside the field of portraiture Mr. Lockwood was conspicuously successful as a flower painter. Numerous samples of his work in the latter field are preserved in the Art Museum, Boston, the Corcoran Art Gallery, Washington, and the Metropolitan Museum of Art, New York. In 1912 he was elected to the National Academy.

LOCKYER, lŏk'yėr, Sir **Joseph Norman,** English astronomer: b. Rugby, 17 May 1836. He was educated privately, entered the War Office in 1857, and in 1870 was appointed secretary of the royal commission on the advancement of science. Five years later he became astronomical lecturer at South Kensington; was director of the Solar Physics Observatory, South Kensington, 1885–1913, and in 1913 director of the Hill Observatory, Salcombe Regis, Sidmouth. He has directed eight eclipse expeditions on behalf of the British government. He was created K.C.B. in 1897. He initiated in 1866 the spectroscopic observation of sunspots; invented in 1868 a spectroscopic method of observing the solar prominences in daylight; and from 1872 successfully engaged in investigations of the chemistry of the sun. He has published ‘Elementary Lessons in Astronomy’ (1870); ‘Contributions to Solar Physics’ (1873); ‘The Spectroscope’ (1873); ‘Primer of Astronomy’ (1874); ‘Studies in Spectrum Analysis’ (1878); ‘Star-Gazing’ (1878); ‘Chemistry of the Sun’ (1887); ‘The Movements of the Earth’ (1887); ‘The Meteoritic Hypothesis’ (1890); ‘The Dawn of Astronomy’ (1894); ‘The Sun's Place in Nature’ (1897); ‘Recent and Coming Eclipses’ (1897); ‘Inorganic Evolution’ (1900); ‘Surveying for Archæologists’ (1909).

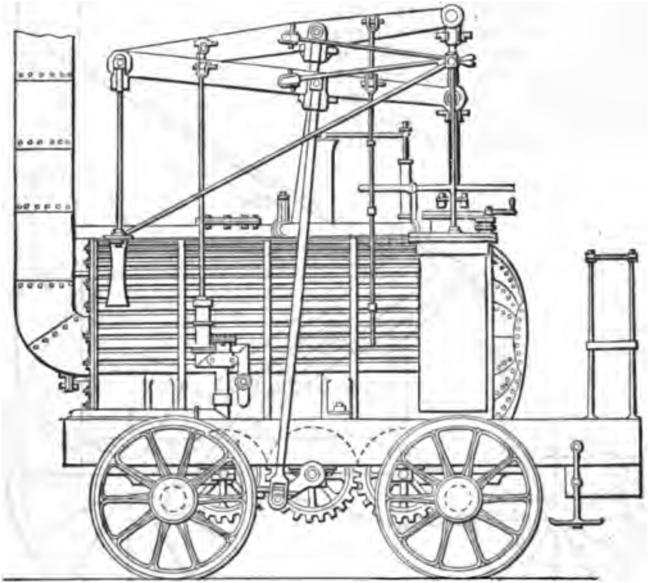
LOCLE, lŏ'kl', **Le,** Switzerland, town of the Canton of Neuchâtel, on the French frontier. The chief industry is watch-making, for which the place is famed. A fire destroyed the greater part of the town in 1833, since when it has been substantially rebuilt. It has a watch-making institute, mechanic school, college, several museums, and a public library. It has an electric-lighting plant. Pop. 12,750.

LOCO DISEASE, a disease found in sheep and horses and occasionally in cattle. It is caused by eating certain species of *Astralagus,* a genus of the natural order *Leguminosæ,* commonly known in the Rocky Mountain region as loco or crazy weeds. The first effects of the weed are stimulating, but continued eating produces vertigo, champing of the jaws, partial or perhaps total deafness or blindness, and if the disease be acute, death may occur within three days. In the chronic form death may be averted for months and sometimes years, but the animal develops nervous symptoms and muscular incoördination, and becomes unable to walk, finally dying of exhaustion or starvation, or both. The disease is a habit acquired usually by healthy animals through association with infected animals that search for and feed almost exclusively on loco weeds. As no medicinal treatment is effective, locoed animals should be separated from a healthy herd. Segregation of infected animals is absolutely necessary to prevent the spread of the disease. Consult Marsh, C. D., ‘The Loco-Weed Disease’ (in ‘Farmers' Bulletin No. 380,’ Department of Agriculture, Washington 1909).

LOCOFOCO, formerly a familiar name for a member of the Democratic party; applied especially to the radical or equal rights section of that party, because at a meeting in Tammany Hall, New York, on 29 Oct. 1835, in which there was great diversity of sentiment, the chairman left his seat, and the lights were extinguished, with a view to dissolving the meeting; when those in favor of extreme measures produced *loco-foco* matches — then a comparatively recent invention, rekindled the lights, continued the meeting, and accomplished their object. (See DEMOCRATIC PARTY). Consult Byrdsall, F., ‘History of the Loco-Foco Party’ (New York 1842); Alexander, De A. S., ‘Political History of the State of New York’ (Vol. II, New York 1906); Woodburn, J. A., ‘Political Parties and Party Problems in the United States’ (2d ed., ib., 1914).

LOCO-WEED, or **LOCO-VETCH.** See CRAZY WEED.

LOCOMOTION, in plants falls naturally into the following divisions: independent locomotion, or free spontaneous movement, occurring in lower forms; extension through growth; projection by elastic machinery, waftage by winds, flotage by water, and carriage by animals. With all of these modes, except the first, this article does not deal. These modes are dealt with under PLANTS, DISTRIBUTION OF; POLLINATION, etc. In regard to independent motion, however, it must be stated that none of the higher plants possess this power, although it is well developed in the lower forms which lack the firm cellulose skeleton. The method of locomotion is similar to that of the simpler animals. Thus some kinds creep; for example, the slime-molds (myxomycetes) get about by directing their protoplasmic streaming in one constant direction, as do some of the Amœba among animals. Other plants, or their reproductive spores, swim freely in water in a manner so similar to that of animals that they are called zoöspores, and these are very characteristic in the Algæ or Seaweeds. The motion is effected either by the action of innumerable cilia, tiny hairs which all in unison beat the water more strongly in one direction than another, or else by flagellæ, resembling tails, except that instead of pushing the spore, they pull it behind them by an action the reverse of that of the tail of a fish. The movements of both cilia and flagellæ depend on the power of contractility in protoplasm. Vibration is used by the blue-green algæ to secure motion. The diatoms and others push out protoplasmic threads which work against the bottom. It would appear that the resemblance to animals in all these modes of locomotion is not accidental, but a persistence from an ancient condition in which the two kingdoms were one.



Railway & Locomotive Engineering

FIG. 1. William Hedley's "Puffing Billy" (1813), now in South Kensington Museum.

LOCOMOTIVE, a self-propelling vehicle, usually a vehicle consisting of a steam engine and boiler, mounted on wheels and so connected as to be capable of self-propulsion along a track.

Historical.— The steam locomotive has been in commercial use since the early part of the 19th century. It was about the year 1825 that manufacturers in Europe and in America began earnestly the construction of locomotives. Prior to this time what locomotives had been built were the results of individual inventors. A Frenchman, Mr. Nicholas Cagnot, exhibited the first model of a steam locomotive, or steam carriage as it is more often described. The exhibition took place in 1763 and is the first of which we have any record. In 1769 Mr. Cagnot built a locomotive, that might be better described as a self-moving steam engine, which was to run on common roads. It had a speed of less than four miles per hour with stops every 15 minutes to build up the steam pressure. Cagnot's second engine was more successful and created considerable attention. While running the engine at a speed of three miles per hour it overturned. The public authorities, who considered it dangerous and a menace to public safety, ordered it locked up. William Murdock of England built a steam carriage in 1784. It had a copper boiler, ran on three wheels and used high pressure steam. Among the earliest and probably the first engine built to run on the public highway in the United

States was that designed and built by Salem Reed of Salem, Mass., in 1790.

We of to-day are inclined to think of these inventions as the forerunners of our steam automobiles and think of the locomotive as operating on rails. In 1802 Richard Trevethick patented the application of the non-condensing engine to the propulsion of carriages on railroads. On 1 Feb. 1804 his engine bearing his name was run on the Merthyr Tydvil Railway in South Wales. The boiler of this locomotive was of the cylindrical type with internal furnace and flue. The steam cylinder which was eight inches in diameter had the relatively long stroke of four feet and six inches. The driving wheels were plain and were driven by means of a connecting rod and crank through a train of gears. The locomotive drew its load of 10 tons, besides the wagons at the rate of 5 miles per hour. It is interesting to note that Trevethick's locomotive was the first to be used for drawing wagons and the Merthyr Tydvil Railway can justly claim the honor of being the first railway company in the world. An act of Parliament established it in 1803. The *Tom Thumb* built in 1829 by Peter Cooper was the first locomotive used on rails in America. During the same year an English locomotive, *The Stourbridge Lion*, was imported. Many types of locomotives combining ingenious ideas besides those referred to were built and experimented with in these early years.

The names of Stephenson, Baldwin and Brooks appear in the following list of early locomotives. Their work is known to all interested in locomotive equipment and their work is largely responsible for the magnificent locomotives we see running to-day.

Blenkinsop's rack locomotive..............	England,	1811
Chapman's chain locomotion..............	England,	1812
Brunton's locomotive....................	England,	1813
Hedley's "Puffing Billy".................	England,	1813
Stephenson's locomotive..................	England,	1815
Stephenson's "The Locomotion"............	England,	1825
Hackworth's "The Royal Gorge"...........	England,	1826
Stephenson's "The Rocket"...............	England,	1829
Miller's "The Friend"...................	America,	1830
Stephenson's "Robert Fulton"............	America,	1831
Baldwin's "Old Ironsides"...............	America,	1832
Brook's locomotive.......................	America,	1837

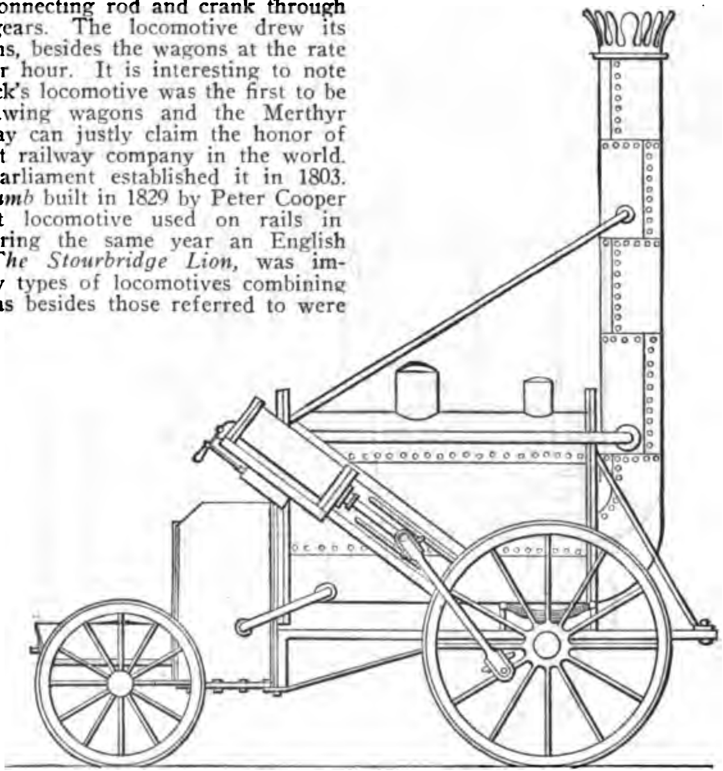
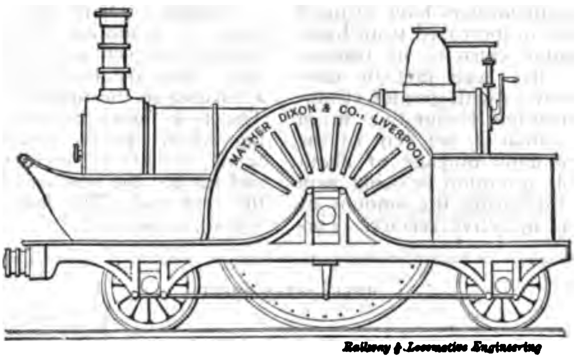

Railway & Locomotive Engineering

Fig. 2. Stephenson's "Rocket" (1829).

The first successful locomotive was built up of a strong rectangular frame upon which the boiler and engine were supported. Axles were fastened to the frame and the two pairs of wheels kept in parallel motion. The first radical change was to extend the base by supporting the front end on a four-wheeled truck, or «bogie» and the back end upon a pair of drivers. Later two pairs of drivers were coupled up and considerable improvement resulted. Subsequently more drivers were added and in some cases a small pair of wheels were placed under the rear end of the boiler.

After the locomotive had been in active service about 20 years there was a demand for higher speed. Heretofore the speed was very moderate. To secure the higher speed the drivers were increased to seven feet in diameter, but they were soon discarded as the locomotive was slow in getting up speed. The time had not arrived, however, for high speed in railroad travel. As yet there were no fixed signals, no air brakes nor reliable systems for regulating single track operation. The application of the air brake in 1873 paved the way for our modern freight and passenger service. For a time the early builders of locomotives believed that there was not sufficient adhesion between the wheels and the track to climb an incline or draw loads. The tractive effort of any locomotive is reached when the driving wheels begin to slip. To increase this limit a definite part of the total weight was carried on the drivers to give the desired adhesion. Another method was to drive separately the individual pairs of drivers. The load on one pair of drivers was limited, however, to the load the right of way would bear with safety. This fact brought into use leading trucks or «bogies» and trailing trucks which received a portion of the weight of the locomotive. An arrangement of this kind increased the wheel base considerable and additional provisions had to be made to enable the locomotive to run around curves. Lateral play was allowed the axles, radial axles were used, axle trucks turning about a pivot which receives a portion of the weight were also used.

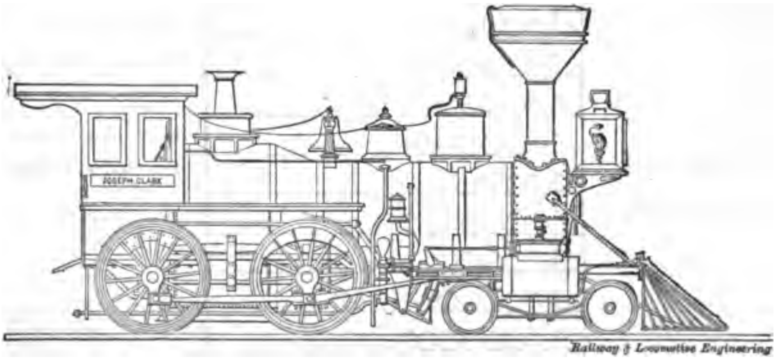


Railway & Locomotive Engineering

FIG. 3. Early Type English Locomotive.

Many forms of valve gears were applied to the earlier locomotives. «Old Ironsides» is equipped with what is known as «the Hook Motion.» This gear was the standard form used in this country for some time even after the invention of the shifting link.

«The Hook Motion» was replaced by the Stephenson link mechanism invented in 1843 by William Howe, an employee of the Robert Stephenson & Company of New Castle, England. Up to 1904 practically all the locomotives in the United States were equipped with this gear. The gear is located between the drivers and provides a means of reversing the engine at will and also permits the volume of steam admitted to the cylinders to be varied by the operator while the engine is running.



Railway & Locomotive Engineering

FIG. 4. Early American Locomotive.

Since 1904 the Walschaert valve gear invented in 1844 by a Swiss named Egide Walschaert and used quite extensively in continental Europe has increased in favor among locomotive builders and is now used to a greater extent in this country. In modern locomotives the use of an outside valve gear such as the Walschaert is practically necessary, because of the increase in size of our locomotives. In the large locomotive the parts of the Stephenson mechanism are very large, thus permitting rapid wear and the accumulation of a great amount of lost motion. The Walschaert valve gear has no eccentrics, only pins, links and bushings. It is easily accessible and maintained. Using a valve gear outside of the frame also permitted better frame bracing and thus reduced the chance of frame failure.

During the last 25 years many improvements have been made. These have led to the superb locomotives now running in Europe and America. Many investigations have been made relative to increased boiler pressures, compounding, use of superheated steam and prevention of smoke, all of which have been of inestimable value.

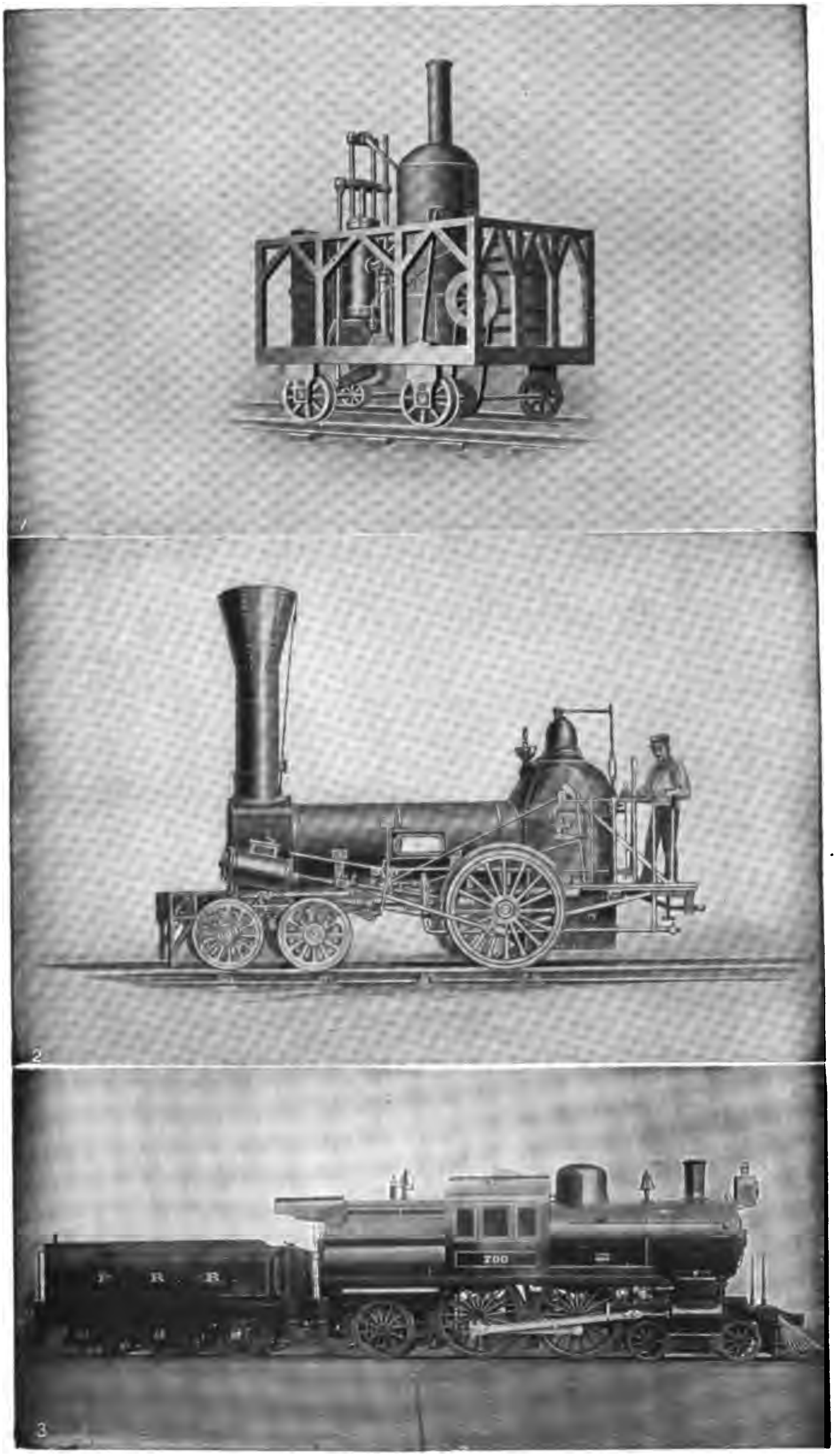
The Locomotive of To-day.— The locomotive might be dealt with as a power plant complete in itself, consisting of boiler, furnace, stack, engine and auxiliaries. It will develop the same amount of power as a stationary power plant occupying several times the amount of space. Modern locomotives are built as high as 3,000 horse power, with a tractive effort of 105,000 pounds. Comparing the economy of the modern locomotive with the locomotive of 20 years ago it will be found that in many cases 50 per cent more work is obtained per pound of coal burned.

The ever-increasing demands and distribution factors presenting themselves have resulted along with other things in increased train loads and as a result greater capacity in tractive effort. This increase has been met by constructing larger locomotives with greater steaming capacity. The average locomotive is in service something less than 20 per cent of the time with an average daily mileage of about 80 miles. Considerable attention is being paid to the possibility of increasing the amount of time the locomotive is in active service. This of course means the changing of crews while the engine is doing useful work.

For the fiscal year ending 30 June 1914, 64,760 locomotives of all classes were in use in the United States as reported by the Interstate Commerce Commission. The total mileage was 1,755,972,325 miles, an average of 27,115 miles per annum per locomotive.

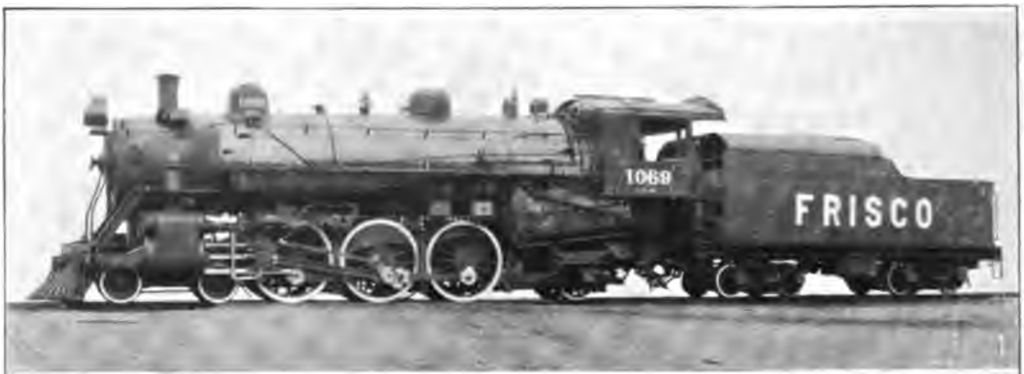
Types.— There are between 30 and 40 types of locomotives in use in the United States, divided between passenger, freight and switching. They are as a rule known and designated according to the number of wheels and drivers. The first figure denotes the number of leading wheels in the front truck or under the front; the second gives the number of drivers and the last the number of trailing wheels under the rear end. The following are some of the types now in use:

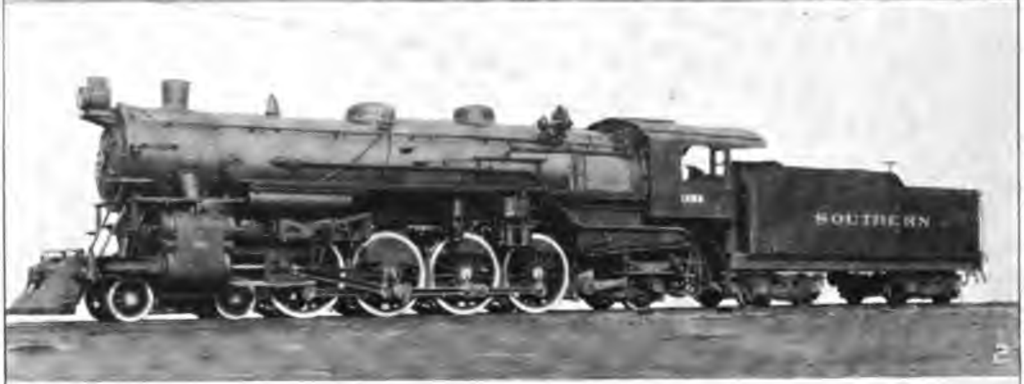
SYMBOL	TYPE	WHEEL ARRANGEMENT	SERVICE
0-4-0	4-wheel switcher.....	⊿▭○○	Contractor or industrial service. Light switching.
0-6-0	6-wheel switcher.....	⊿▭○○○	Switching.
0-6-6-0	Mallet articulated....	⊿▭○○○▭○○○	Heavy freight.
0-8-0	8-wheel switcher.....	⊿▭○○○○	Switching.
0-8-8-0	Mallet articulated....	⊿▭○○○○▭○○○○	Heavy freight.
2-4-0	4 coupled............	⊿o▭○○	Suitable for short runs, light service and moderate speed.
2-6-0	Mogul..............	⊿o▭○○○	Freight.
2-8-0	Consolidated.........	⊿o▭○○○○	General freight.
2-10-0	Decapod............	⊿o▭○○○○○	Heavy freight.
4-4-0	American (8 wheeler).	⊿o▭o○○	Passenger, freight and mixed service.
4-6-0	10 wheeler...........	⊿o▭o○○○	Passenger and fast freight.
0-4-2	4 coupled and trailing.	⊿▭○○o	For short runs and limited supply of fuel and water.
0-6-2	6 coupled and trailing.	⊿▭○○○o	Short runs.
0-4-4	Fordney, 4 coupled...	⊿▭○○oo	Used as double enders.
2-4-2	Columbia...........	⊿o▭○○ o	Light road service.
2-6-2	Prairie..............	⊿o▭○○○o	Heavy passenger and fast freight.
2-8-2	Mikado.............	⊿o▭○○○○o	General freight service on sharp curves.
2-10-2	Santa Fé............	⊿o▭○○○○○ o	Heavy freight service on sharp curves.
2-4-4	4 coupled, double ender........	⊿o▭○○oo	For logging, industrial or light road service.
2-6-6-2	Mallet articulated....	⊿o▭○○○▭○○○o	Heavy freight.
2-8-8-2	" "	⊿o▭○○○○▭○○○○o	" "
2-8-8-0	" "	⊿o▭○○○○▭○○○○	" "
2-10-10-2	" "	⊿o▭○○○○○▭○○○○○ o	" "
2-8-8-8-2	Mallet artic triplex...	⊿o▭○○○○▭○○○○▭○○○○ o	Heavy freight.
4-4-2	Atlantic............	⊿o▭o○○o	High speed passenger service.
4-6-2	Pacific..............	⊿o▭o○○○o	Heavy fast passenger and fast freight.
4-8-2	Mountain...........	⊿o▭o○○○○o	Heavy passenger.

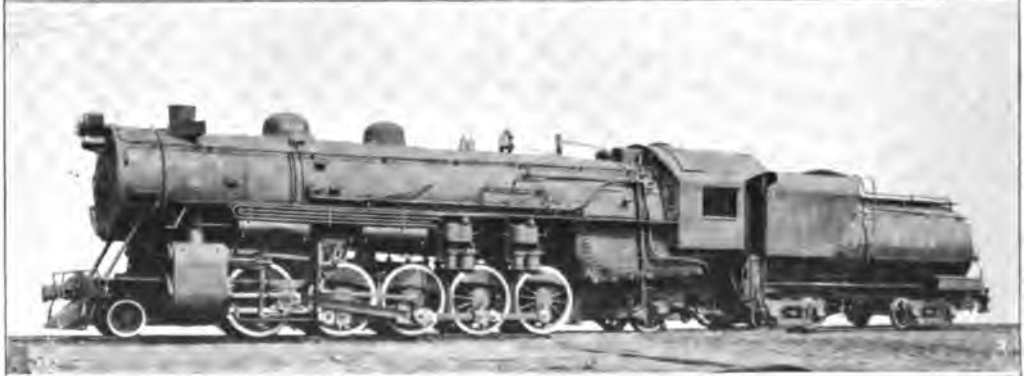


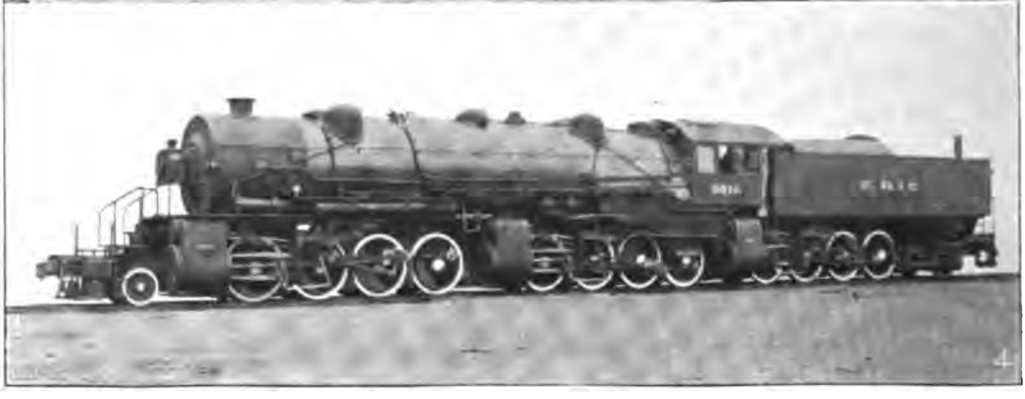
1 American Locomotive of 1830 2 American Locomotive of 1840
3 American Locomotive of 1900

LOCOMOTIVES









1 Pacific type for heavy passenger service
2 Mountain type for passenger service
3 Heavy freight service type
4 Freight type with three groups of driving wheels, one of the largest engines in the world

The most common types in railroad service are the 4-4-0 (American); 4-4-2 (Atlantic); 2-6-0 (Mogul); 4-6-0 (10 wheeler); 2-6-2 (Prairie); 4-6-2 (Pacific); 2-8-0 (Consolidated); 2-8-2 (Mikado); and 0-6-0 (6 coupled switching).

Each type is manufactured in different weights with various tractive efforts dependent to a certain extent upon the weight. The following table indicates the average range in weight:

TYPE		Weight in pounds
4-4-0	American	30,000 to 136,000
4-4-2	Atlantic	126,000 to 215,000
2-6-0	Mogul	30,000 to 164,000
4-6-0	Ten-wheeler	51,000 to 205,000
2-6-2	Prairie	28,000 to 134,000
4-6-2	Pacific	90,000 to 282,000
2-8-0	Consolidated	42,000 to 234,000
2-8-2	Mikado	86,000 to 320,000
0-6-0	Six-coupled, switching	18,000 to 155,000
2-8-8-2	Mallet	204,000 to 520,000

Types for Passenger Service.— The 4-6-2, or Pacific type locomotive, is best suited for the present-day demands in fast passenger service. It is used to a considerable extent where a tractive effort of 40,000 to 45,000 pounds is required. Where long heavy trains are operated or where extra heavy grades are prevalent, the Mountain type of locomotive, or 4-8-2, is growing in favor. The Atlantic, 4-4-2, and the Prairie, 2-6-2, are used extensively on the shorter runs or where local operation prevails.

Types for Freight Service.— It was but a few years ago that the Consolidation, 2-8-0, locomotives comprised about 30 per cent of the locomotives in use. For heavy freight service and for fast trains it is being replaced by the heavier type of Mikado or 2-8-2. The Mikado is used mainly where the tractive effort required is about 55,000 pounds. For heavier service and up to 83,000 pounds tractive effort, the Santa Fé, 2-10-2, is becoming popular. The Santa Fé appears to give better results for heavy slow service than either the Consolidated or Mikado. Where the service is exceptionally heavy the Mallet articulated types of locomotives are growing in favor. These engines are built with tractive efforts exceeding 100,000 pounds. The Mallet articulated compound locomotive was used in some of the mountainous districts of Europe prior to such modifications as were necessary to adapt it to requirements set by the railroads of this country. Practically two locomotives, considering the drivers and cylinders, are combined. It has one boiler and one furnace and lends itself to a more advantageous application of the compounding principle.

Types for Switching Service.— The 0-6-0 type is the most common type of switch engine. Occasionally the Mallet 0-8-8-0 is used with a tractive effort of 100,000 pounds. A type more commonly found, however, than the 0-8-8-0 for heavy switching is the 0-8-0, especially where the tractive effort required is about 70,000 pounds.

FUELS.

As a general rule the major operating cost in the operation of steam locomotives is for fuel which to a considerable extent comprises different kinds of many grades. The kind of fuel used plays an important part in the proportioning of the boiler and furnace and should always be given careful consideration. A thorough knowledge should be had relative to the various fuels, their composition, condition of operation when using same, quantities required, cost, availability and education of crews operating the locomotive.

Wood.— On logging railroads wood is almost universally used as a fuel for locomotives. Approximately two and one-fourth pounds of dry wood are equivalent in heating value to one pound of soft or bituminous coal. The average composition of several kinds of dry wood by weight is as follows:

Carbon	49.75 per cent
Hydrogen	6.05 per cent
Oxygen	41.35 per cent
Nitrogen	1.05 per cent
Ash	1.80 per cent
	100.00

Wood which has not been specially dried contains considerable moisture, generally between 20 and 40 per cent. It is advisable, therefore, to dry the wood and keep the same protected as it will absorb about 15 per cent of water when exposed to the atmosphere.

Comparative value of different kinds of wood for fuel are given in the following table:

KINDS OF WOOD	Relative value as a fuel	Weight of one cord in pounds
Red oak	1.00	3,254
Shell bark hickory	1.45	4,469
Chestnut white oak	1.25	3,955
White oak	1.17	3,821
White ash	1.12	3,480
White beech	.94	3,236
Black walnut	.94	3,044
Black birch	.91	3,115
Yellow oak	.87	2,919
Hard maple	.87	2,878
White elm	.84	2,592
Large magnolia	.81	2,704
Soft maple	.78	2,668
Soft yellow pine	.78	2,463
Sycamore	.75	2,391
Chestnut	.75	2,333
White birch	.70	2,369
Jersey pine	.70	2,137
Pitch pine	.62	1,904
White pine	.61	1,868

Fuel Oil.— Fuel oil has been used to a limited extent and more especially in the territory adjacent to oil wells. Where economic and commercial conditions permit it is the most desirable fuel. The absence of smoke and ashes, prompt kindling and extinguishing of fires, extreme rate of combustion and ease with which it can be handled and controlled are marked advantages in favor of fuel oil. The reduction in volume and weight over an equivalent quantity of coal for heating value and the increase in boiler efficiency are factors of no mean importance.

Crude oil consists mainly of hydrocarbons together with small quantities of nitrogen, oxygen, sulphur and water. The average composition by weight of typical American fuel oils is as follows:

Carbon, per cent	82.0 to 86.0
Hydrogen, per cent	14.0 to 11.0
Oxygen, per cent	3.8 to .6
Sulphur, per cent	.0 to 1.6

One barrel of crude oil contains 42 gallons and weighs from 310 to 350 pounds. Compared with coal, oil occupies 50 per cent less space and is 35 per cent less in weight for equal heat values.

Comparative Heat Values of Coal and Oil.

B. T. U. PER POUND OF COAL	Pounds of coal equal to 1 barrel of oil	Barrels of oil equal to 2,000 lbs. of coal
10,000	620	3.2
11,000	560	3.6
12,000	520	3.9
13,000	480	4.2
14,000	440	4.5
15,000	410	4.8

Coal.— The principal fuel used for locomotives in America is coal. Coal may be divided into three principal kinds, anthracite, semi-bituminous and bituminous coal.

Anthracite.— Anthracite coal used in this country comes mostly from Pennsylvania and its use for locomotives is confined almost exclusively to a few railroads operating in the eastern part of the United States. This coal ignites very slowly and burns at a high temperture. It gives off almost no smoke and the flame is very short.

Heating Value of Anthracite Coal.

LOCATION	Fixed carbon	Volatile matter	Ash	Heating value per lb. of combustible
Lackawanna...	84.0%	5.0%	11.0%	13,900 B. T. U.
Lykens Valley..	81.0%	5.0%	14.0%	13,650 B. T. U.
Scranton......	84.4%	6.5%	9.0%	13,800 B. T. U.

Semi-Bituminous.— This is a softer coal than anthracite though in appearance it resembles the hard coal. It is lighter than anthracite and burns more rapidly and is capable of maintaining a very intense heat.

Heating Value of Semi-bituminous Coal.

LOCATION	Fixed carbon	Volatile matter	Ash	Heating value per lb. of combustible
Blassburg, Pa..	73.0%	15.0%	11.0%	13,500 B. T. U.
Cumberland, Md........	80.8%	13.0%	5.0%	16,320 B. T. U.
Pocahontas, W. Va.........	74.5%	18.1%	6.6%	15,740 B. T. U.

Bituminous Coal.— Coals that contain over 20 per cent volatile matter are usually classed as bituminous coals, and are divided into three classes: coking, non-coking and cannel coals. “Coking Coals” is a term applied to coals that fuse together and become pasty on being heated. They are rich in hydrocarbons and are used in gas manufacture. “Non-Coking Coals” do not fuse together during combustion and are free burning. “Cannel Coals” are rich in carbon, burn readily and with a bright flame. It is very homogeneous, breaks without any definite line of fracture and has a dull, resinous lustre. It is a valuable gas coal and is used but to a small extent for steaming purposes.

Heating Value of Typical Bituminous Coals.

LOCATION	Fixed carbon	Volatile matter	Ash	Water	Heating value per lb. of combustible
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*B. T. U*
Freeport, W. Va.	61.55	28.58	8.39	1.48	14,069
Hocking Valley, Ohio.........	49.54	34.14	9.67	6.65	13,053
Pere Marquette, Mich........	53.95	31.14	2.76	12.15	14,160
Brazil, Ind.....	50.30	34.49	6.33	8.98	12,417
Eastern Field, Ky..........	56.39	36.12	4.39	3.10	14,148
Horse Creek, Ala..........	53.28	31.84	12.54	2.34	12,850
Fleming, Kan...	49.36	32.68	12.97	4.99	12,242
Laddadale, Ia...	45.02	30.74	16.00	8.24	11,027
Rich Hill, Mo..	28.73	33.58	19.36	8.33	10,586
Coffeen, Ill.....	42.81	29.48	13.28	14.43	10,064
Cambria, Wyo..	34.82	35.02	20.72	9.44	9,650
Chariton, Ia....	41.49	30.49	12.63	15.34	10,242

The principle bituminous coals used are mined in Ohio, West Virginia, Pennsylvania and Illinois.

Powdered or Pulverized Coal.— The value of powdered coal as a fuel for steaming purposes has long been known. Despite the many advantages of powdered fuel, little progress has been made toward its general adoption. Among the advantages obtained in burning powdered coal are:

Complete combustion and total absence of smoke.

A cheaper grade of bituminous coal can be burned.

The locomotive boiler may be rapidly forced above its rated capacity. The labor of firing is reduced to a minimum. The constantly increasing demand for the better grades of coal and oil throughout the country has brought about a condition where it is difficult to obtain such fuel at reasonable, prices. The yearly expenditure for fuel used in locomotives of the United States exceeds $300,000,000. The limited supply of oil should of necessity be conserved for other purposes.

Investigations show that any fuel in a dry-powdered state 66⅔ per cent combustible is suitable for generating steam. Anthracite, bituminous and semi-bituminous coals, lignite, peat, anthracite culm, dust and slush slack, screenings and dust may all be burned in a pulverized state. They should all be in about the same condition as dry Portland cement.

The raw fuel is dried, pulverized and stored in fireproof containers. It is handled with the same care as fuel oil. For firing up a locomotive the usual steam-blower is turned on in the stack, a piece of lighted waste is put through the firebox door opening and placed on the furnace floor, just ahead of the primary arch, after which the pressure blower and one of the feeders is started. Less than an hour is generally sufficient for getting a full head of steam. The powdered fuel, having been supplied to the enclosed tank on the tender, gravitates to a helicoidal conveyor which conveys it to the feeders where it is commingled with air under pressure which forces the mixture through the connecting hose to the nozzles leading into the fuel and air mixers. Additional air is supplied in the mixers and the mixture is then drawn into the furnace by the flue draft and combustion takes place.

The maximum temperature is from 2500° to 2900° F. under the main arch. Liquid ash runs down the front and sides of the combustion zone and is precipitated into self-cleaning slag pans where it is cooled and solidifies.

Many experiments are being conducted and various applications for burning powdered fuel are being tried out. Extensive developments may be expected within the next few years and the locomotive equipped for burning pulverized fuel will not be uncommon.

Coke.— Coke is used to a limited extent in certain portions of roads where smoke is objectionable, such as in tunnels, cities, etc. It is not as a general rule desirable on account of its slow ignition and great bulk for a given weight. The best cokes are those from Pennsylvania and Virginia.

Composition of Coke.

LOCATION	Carbon carbon	Ash	Sulphur
Connellsville, Pa.	89%	10%	1%
Pocahontas, Va.	93%	6%	1%

Combustion.— Combustion takes place when the elements or the constituents of a fuel, which are mainly carbon and hydrogen, form a chemical combination with oxygen and produce oxides. Heat accompanies this chemical action and it is this heat which is partially utilized in generating steam.

Air Required for Combustion.—Air is used to supply the necessary oxygen for maintaining and supporting the combustion. The composition of air is approximately 23 per cent oxygen (O_2) and 77 per cent nitrogen (N_2) by weight, or 21 per cent O_2 and 79 per cent N_2 by volume. To secure one pound of oxygen in the furnace it will therefore be necessary to supply $\frac{1.}{.23}$ or 4.35 pounds of air. Ordinarily in practice from 25 to 100 per cent more air is provided than is required for complete combustion. Naturally the less this excess, still maintaining complete combustion, the better the efficiency as this excess air leaves the boiler at a much higher temperature than when introduced into the furnace, thus carrying away heat.

Let C, H and O denote respectively the parts by weight of carbon, hydrogen and oxygen in one pound of fuel. Carbon dioxide (CO_2) is formed by the complete combustion of carbon and by the proportion of molecular weights 12 pounds of C combine with 32 pounds of oxygen to form 44 pounds of CO_2. In other words one pound of carbon requires 2.67 pounds of O_2 or 11.6 pounds of air. By a similar method one pound of H_2 requires 8 pounds of O_2 or 34.8 pounds of air.

There is often a small quantity of oxygen in the fuel itself and we consider that this will be united with the hydrogen as far as it is possible. Then the minimum weight of air required for complete combustion may be obtained by the following equation.

$$11.6C+34.8(H-\frac{O}{8})=\text{Pounds of air.}$$

The volume of air at 62° F. and atmospheric pressure theoretically required for complete combustion is arrived at by multiplying by the corresponding volume per pound of air which gives

$$147C+441(H-\frac{O}{8})=\text{Cu. ft. of air.}$$

Example: Determine the pounds of air and cubic feet of air theoretically required for the complete combustion of the wood with the composition as given above.

$$11.6\times.4975+34.8(.0605-\frac{.4135}{8})=65.077 \text{ lbs. of air.}$$

$$147\times.4975+441(.0605-\frac{.4135}{8})=77.0 \text{ cu. ft. of air.}$$

One pound of fuel oil requires considerably more air than wood and more than any of the fuels mentioned heretofore.

$$11.6\times.82+34.8(.14-\frac{.038}{8})=14.22 \text{ lbs. of air.}$$

$$147\times.82+441(.14-\frac{.038}{8})=178.19 \text{ cu. ft. of air.}$$

The above figures indicate the importance of giving due consideration to the fuel used as space must be provided for admitting the proper quantity of air. At the same time the resistance offered to the passage of air through the fuel bed should be considered.

Heating Value.— As mentioned before a chemical action is accompanied by the generation of heat. The heat generated when one pound of combustible is completely burned is called the heating value. Heating values are determined as a rule by various calorimeters. The heating value of a fuel depends upon the quantities of carbon and hydrogen which it contains. Some fuels contain sulphur which generates some heat and requires a definite amount of oxygen for combustion. It is generally disregarded however in making computations.

The heating value of a fuel may be approximated by computing the quantities of heat which the combustible constituents contained in the fuel would produce if burned separately and taking the sum.

The heat liberated in burning one pound of carbon completely is 14,650 B. T. U. One pound of hydrogen completely burned liberates 62,100 B. T. U.

Using the same symbols for the constituents as were used in arriving at the theoretical quantity of air necessary for combustion we can write.

British thermal units (B. T. U.)$=14{,}650\,C+62{,}100\,(H-\frac{O}{8})$.

The above formula is known as Dulong's equation and is used extensively in estimating the heating value of fuels when the ultimate analysis is known. To determine the heating value of wood from the composition heretofore given, we write

$$14{,}650\times .4975+62{,}100\,(.0605-\frac{.4135}{8})=8{,}835$$

B. T. U. per lb.

Fuel oil according to the analysis given under fuel has the heating value of

$$14{,}650\times .82+62{,}100\,(.14-\frac{.038}{8})=20{,}412$$

B. T. U. per lb.

If it is desired to consider the heating value of the sulphur content, one pound of sulphur when completely burned will liberate 4,050 B. T. U. The weight of sulphur in one pound of the fuel is therefore multiplied by 4,050 and added to the sum of the heat liberated by the other constituents in determining the heating value of the fuel.

Water.— For many years, the water supply was considered one of quantity only, regardless of the kind. Quantity of course is of prime importance, but considerable expense in maintenance and operation can be saved by scientific handling and treatment of the water used. In certain localities the waters, though unfit for drinking purposes, may not contain substances which make them undesirable for boiler use. Some waters though very good for drinking purposes contain material which either cause the formation of soft scale, hard scale, corroding or foaming. Soft and hard scale are poor conductors of heat, and upon collecting in the tubes and on the heating surfaces surrounding the firebox reduce the heat transmission besides clogging up the passages. As the heat transmission is retarded the boiler plates next to the hot gases and the tubes become overheated which causes leaks and trouble with the engine's cylinder parts and steam passages. Relief is found by constant washouts, but this is an expensive method to pursue. It causes delays, layovers of considerable time and is hard on the life of the boiler in that cooling and heating up cause unequal expansion in the various parts which results in a loosening at the connections.

Foaming is the most troublesome and most difficult to remedy. Broken cylinder parts, blowing out of packings, cutting of reciprocating parts are quite frequently the result of foaming. Quite often foaming causes trouble with the fire-box sheets and tube sheets. Considerable waste of water and heat occurs in that water is carried along with the steam to the cylinders, especially when the boiler is being forced as in climbing grades.

Treatment of Water.— In the case of soft scale due to the presence of lime carbonate and magnesia carbonate it is advisable to neutralize with slaked lime and give the boiler washouts frequently. Hard scale is due to the presence of lime and magnesia sulphates. Foaming is possible as an after trouble. Soda ash with slaked lime acts as a remedy and the boilers should be washed out frequently. Changing of the water and blowing out is also advisable whenever possible.

Acids and chlorides in the water cause corrosion and foaming. The boiler should be closely inspected frequently, blown out and the water changed. Slaked lime or soda ash are helpful in relieving this trouble.

Foaming is frequently caused by the presence of alkali and mud in the water fed to the boiler. Diluting the water with other waters quite often gives relief. Distillation alum acts as a neutralizer. The boiler should be blown out often and the water changed frequently. Where water of sufficient purity is not available for the boilers many of the railroad companies are finding it necessary to render the available supply suitable by treatment and water-softening plants are being installed at the watering stations and terminals. Most of the companies employ chemical engineers to make a study of different waters used along the right of way and treat the waters, figuring the cost as against the interest and depreciation on the additional locomotives required for their service. Cost of cleaning the boilers, decrease in efficiency and capacity are also balanced up.

The Locomotive Firebox and Combustion Chamber.— The locomotive boiler consists essentially of a rectangular firebox and a cylindrical shell through which numerous tubes pass from firebox to the smoke box, terminating in tube sheets. The products of combustion after passing the length of the tubes enter the smokebox and pass up the smoke stack with the exhaust steam from the steam cylinders. A forged steel ring joins the firebox with the outer shell. Near this ring are several hand holes for cleaning out the space between the shell and the firebox. This space is commonly called the water leg. All plates of the boiler and firebox that are not of cylindrical shape require staying to keep them in place. For example, the cylindrical shell of a tubular boiler does not require staying or bracing as the internal pressure tends to keep it cylindrical. Flat surfaces tend to bulge and must be held in place. The placing of stays and the arrangement plays an important part in the design of a boiler and must be worked out for each special type. Many different methods of staying will be found, and there are quite often several ways of staying the same kind of surface. The firebox and flat ends of the boiler require staying. However, a portion of the tube sheets are sufficiently held in place by the tubes. The water leg is stayed by screwed stay bolts riveted at the ends. These stay bolts are likely to crack or break off on account of the expansion of the firebox. In order to detect such a failure the stay bolts are often drilled from the outer end nearly through to the inner end. In case of failure steam will blow out the defective stay and thus give warning. The crown sheet of the firebox is exposed to intense heat while covered with but a few inches of water. The staying of the crown sheet is one of the most difficult problems met in locomotive boiler construction. To avoid the difficulties of staying the crown sheet, the firebox end of the boiler shell is sometimes made flat on top. Tubes for a locomotive boiler are as a rule made smaller than for stationary boilers and are spaced much more closely. Two-inch tubes are used generally, although in some cases smaller tubes have been used. The boiler is fastened rigidly to the frame of the locomotive at the smokebox end. A small longitudinal motion on the frame at the firebox end is provided for by expansion pads.

Firebox.— Two functions are performed by the firebox. Burning of the fuel and liberation of the heat contained is first and most important. The second function is to permit the transmission of the heat through the firebox heating surfaces to the water. Under normal conditions only a part of the fuel burns on the grates. A considerable portion, approximately one-half, of the heat is liberated by the burning of the gases above the fuel bed and in the tubes. Sufficient air supply, complete mixing of the gases and ample combustion space are necessary to prevent a large amount of combustible gases from passing out the smoke stack.

Combustion Chamber.— The firebox furnishes seldom more than 10 per cent of the total heating surface, but is responsible for more than 25 per cent, and sometimes as high as 50 per cent of the total evaporation. It is very essential that sufficient combustion space be provided in which the combustible gases given off by the fuel bed can burn and give off their heat. The carbon in the fuel next to the grates may be completely burned to carbon dioxide, but in passing up through the fuel bed freshly placed will leave largely as carbon monoxide. If no place is provided for this gas to burn it will pass up the stack and lower efficiency will result.

Mechanical Stokers.— Mechanical stokers have been applied to a limited extent within recent years. On account of the increased size of the locomotive the ultimate capacity of the heating surface cannot be realized by hand firing and relief is sought in the application of mechanical firing. Many experiments are being conducted and the use of stokers is becoming more general.

Steam Action.— To understand the action of the steam in a modern locomotive let us take for example a locomotive about to start on its trip. A good fire is burning on the grates, the steam pressure is up to maximum and a sufficient coal and water supply is on the tender. On opening the throttle, after setting the shifting lever, the steam enters the steam chest above the engine cylinders, having passed through the superheater, if the locomotive is so equipped, and through the steam pipes connecting the superheater or boiler with the steam chest.

The steam then enters whichever end of cylinder is opened through the steam chest or valve chamber and due to its pressure causes the piston to move. The piston being connected to the piston rod forces the crosshead and connecting rod and crank to perform their function of turning the axles upon which are mounted the driving wheels and valve mechanism. A movement of the valve mechanism causes a movement of the valve in the valve chest which admits the steam alternately to opposite ends of the cylinder and at the proper time permits the steam in the cylinder that has done its work to escape through the exhaust pipe and pass up the stack, thus producing a suction and creating a draft in the firebox.

The valve and its movement are so designed that four events take place in each end of the cylinder as the piston moves from one end to the other and back again, which requires one revolution of the drivers. One revolution of the drivers causes the valve to move from one end of its travel to the other and back again. When the valve is at one end of its stroke steam can enter the cylinder and when it is at the other end the steam can leave the cylinder. The opening and closing by the valve is a process continually kept up and the opening varies from zero to its maximum. The valve starts to uncover the steam port slightly before the piston reaches the end of its stroke and we say admission takes place. Steam continues its flow into the cylinder and the piston starts on its working stroke. Before the stroke is complete the valve shuts off the steam and we have the cut off. The steam in the cylinder then expands, doing work until the valve moving in the opposite direction opens the exhaust port and allows the steam to escape. This last event is called release, which as a rule occurs slightly before the piston reaches the end of its working stroke. The piston completes its working stroke and starts its return stroke, forcing the steam out of the cylinder. Before the piston completes its return stroke the valve has started to close the exhaust port and upon closing we have the fourth event or compression. Some steam is caught in the cylinder and compressed until admission occurs and a new cycle begins.

A similar cycle is performed in the other end of the cylinder and so timed that when exhaust and compression are taking place in one end admission and expansion are taking place in the other. The above-described events are changed at the will of the engineer by setting the shifting link for different cut-offs. When the shifting link is moved forward from mid-position the cut-off is increased and the locomotive will run ahead. If he pulls the lever back of mid-position the locomotive will be reversed. The nearer mid-position, the earlier the cut-off occurs and the less steam is admitted. The events of the stroke are expressed in per cent of the stroke completed in which they occur. For instance 25 per cent cut-off means the steam is cut off when the piston completes 25 per cent of its working stroke.

Valve Gears.— The Stephenson link motion and the Walschaert radial valve gear are the most common valve gears used in this country and have been briefly described under the caption *Historical.* More detailed description will be found in texts on Valve Gears.

Superheaters.— Few locomotives are now built without superheaters. The Schmidt firetube superheater was applied successfully as early as 1906, and the resulting economy in fuel and water together with its suitability to the requirements of American railroads has placed the superheater among the important elements of the modern locomotive. To-day there are over 21,000 locomotives equipped with superheaters in the United States and Canada. Superheaters are applied to between 90 and 95 per cent of all the standard gauge steam locomotives built in the United States. The application of superheaters results in an increased boiler capacity of about one-third, and a saving in fuel of between 20 and 25 per cent. This increase in economy has made it possible for the average fireman to fire heavier locomotives. Superheated steam effects an economy by reason of its temperature being above the saturation temperature of steam at the same pressure and also by reason of its increased volume. At high temperatures superheated steam behaves like a gas. Considerable heat may be abstracted without producing liquefaction, whereas the slightest absorption of heat from saturated steam results in condensation. If superheat is high enough to supply not only the heat absorbed by the cylinder walls but also the heat equivalent of the work done during expansion, then the steam will be dry and saturated at release. Greater superheat than this will result in a loss of energy unless the steam is exhausted into another cylinder. In most cases superheat is only carried so far as to reduce initial condensation. To obtain dry steam at release the steam at cut off must be superheated 100° to 300° F. above saturation temperature, depending upon the initial condition of the steam and the number of expansions. It is evident that the increased efficiency obtained by any superheat in excess of that needed to prevent condensation must be due to increased volume of the steam per unit weight.

A moderate amount of superheat produces a considerable increase in volume, the pressure remaining constant, and reduces the weight of steam per stroke for a definite amount of work.

The general trend of engineers is toward the use of higher superheats and steam temperature of 600° F. are not uncommon. There is no doubt that the limit of superheat is reached when the exposed machine parts are unable to withstand the higher temperatures.

Several types of superheaters have been applied to locomotives but the design of the fire tube superheater fits so well the requirements of American railroads that it is the universal favorite.

Feed-Water Heaters.— The function of the feed-water heater as applied to the locomotive is that of heating the feed water, while that of the feed-water heater installed in a power plant is often to assist in purification of the feed water. Generally speaking there is a gain of 1 per cent in heat for every 10 degrees that the feed water is heated when the heat which increases the feed water temperature would otherwise be wasted. Again, the smaller the difference in temperature between the feed water and the steam, the less would be the strain on the various parts subjected to changes of temperature. In European countries the application of feed-water heaters is rapidly becoming general. Not a great amount of attention however has been given to the methods of heating feed water for locomotive boilers in this country, though many American railways are alive to the possibilities and the increased economy resulting therefrom.

Waste heat from two different sources is available, namely, exhaust steam and gases from the combustion chamber. The thermal efficiency of the average locomotive operating under good condition is about 7 per cent. In other words, 7 per cent of the total heat in the coal fired represents useful work at the draw bar. Losses in the gases from the combustion chamber total nearly 18 per cent and that lost in the discharged exhaust steam about 65 per cent. Proportional and maintenance difficulties are greater in heaters designed to absorb heat from the furnace gases though the gases are at a higher temperature and greater transmission per unit of area might be expected if sufficient quantities of the gases could be brought in contact with the heating surfaces. Attention should be first given to perfecting a feed-water heater to absorb all the heat possible from the exhaust steam and later attempt to use the heat in the hot gases as is done by the economizer in steam-power plants. The exhaust steam does some work in producing draft, and of course cannot be considered as a dead loss. However, a small proportion of this heat could perform the work in producing a satisfactory draft.

A feed-water heater based on the principle of the Lovekin film heater applied in marine practice has been designed and used on high-speed passenger locomotives capable of heating feed water from 45° to 225° F. A back pressure of 10 pounds existed in the cylinder. Two hundred and twenty-five degrees feed water is still about 160° below steam temperature and any additional heating could be done by the exhaust gases which frequently have a temperature of 700° F. or more.

From what work has been done it appears that a 10 per cent economy can be expected under reasonable conditions of operation. The logical location of a feed-water heater is on the front deck, close to the cylinders, and under the extension at the front. It is advisable in order to secure higher temperatures in the feed water to use the closed type of heater with a pump to deliver the water to the boiler through the heater against the boiler pressure. The exhaust steam from the pump should be discharged into the heater.

Locomotive Performance.— The indicated horse power, or horse power developed in the cylinders, of any locomotive may be computed as for any steam engine. The work done in the cylinder equals the product of the average force acting on the piston and the space traversed. Using the units in pounds and feet gives a result in foot pounds which if divided by 33,000 foot pounds considering one minute in time gives horse power.

Let A = Area of piston in square inches.
d = diameter of cylinder in inches.
L' = length of stroke of piston in feet.
N = revolutions per minute.
P = mean effective pressure on piston in pounds per square inch during one revolution.

Then the horse power developed in one end of the cylinder will equal

$$I.H.P. = \frac{PL'AN}{33,000} = \frac{P \times L' \times \pi \times d^2 \times N}{4 \times 33,000}$$

As work is done in each end of the cylinder and there are ordinarily two cylinders on each locomotive the total horse power of the locomotive equals

$$I.H.P. = \frac{4\ PL'AN}{33,000} = \frac{4 \times PL' \times \pi \times d^2 \times N}{4 \times 33,000} = \frac{PL'd^2N}{10,504}$$

If L is expressed in inches

$$I.H.P. = \frac{PLd^2N}{126,050}$$

Let V = speed in miles per hour
D = diameter of drivers in inches.

Then $I.H.P. = \dfrac{PL'd^2V}{31.25D} = \dfrac{PLd^2V}{375D}$.

The maximum horse power is usually attained at speeds of from 25 to 35 miles per hour in freight locomotives, and at speeds of 50 to 60 miles per hour in passenger locomotives.

Efficiency (Mechanical).— Mechanical efficiency represents the ratio of the horse power at the tender drawbar to the indicated horse power (I. H. P.) developed in the cylinder.

The losses include (*a*) friction in all the mechanisms; (*b*) air resistance; (*c*) grade resistance, and (*d*) acceleration resistance. These losses vary from 10 to 30 per cent of the I. H. P.

Tractive Force.— The tractive force in pounds for simple locomotives considering drop in pressure due to expansion, friction and wire drawing is expressed by the formula

$$F = \frac{.8\ Pd^2L}{D}.$$

Some authorities use .85 instead of .8.

The following formulæ for different types of locomotives are used by certain locomotive builders:

Simple 2-cylinder locomotives working simple $F = \frac{.85\ Pd^2L}{D}$.

Compound 2-cylinder locomotives working simple $F = \frac{.8\ Pd_{\eta}^2L}{D}$.

Compound 2-cylinder locomotives working compound $F = \frac{.67\ Pd_{\eta}^2L}{D}$.

Compound 4-cylinder locomotives working simple $F = \frac{1.6\ Pd_{\eta}^2L}{D}$.

Compound 4-cylinder locomotives working compound $F = \frac{.67\ Pd_{\eta}^2L}{D} + \frac{.25\ Pd_{\text{L}}^2L}{D}$.

Mallet compound 4-cylinder locomotives working compound $F = \frac{.52\ Pd_{\text{L}}^2L}{D}$.

d_{η} = diameter of high pressure cylinder in inches.

d_{L} = diameter of low pressure cylinder in inches.

Tractive force determined by the above formulæ holds when the locomotive is operating on a level track at a uniform speed up to seven miles per hour.

As the speed increases and the cut-off is reduced or takes place earlier in the stroke the resulting tractive force is less.

Drawbar Pull.— The drawbar pull or tractive force of a locomotive is indicated on a dynamometer. This force is dependent upon the weight of the locomotive on the driving-wheels and upon the power of the locomotive. The drawbar pull at that point where the driving-wheels begin to slip is known as the adhesion of the locomotive. The adhesion varies with the coefficient of friction between the driving-wheels and the track. Values of the coefficient of friction are given in the following table:

Dry rail, good condition	$f = .20$ to .25
Maximum with sand	$f = .33$
Moist rail	$f = .15$
Worst condition	$f = .125$

Drawbar pull = weight on drivers in pounds times f.

Engineering News gives $R = 2 + \frac{V}{4}$

Baldwin Locomotive Works gives $R = 3 + \frac{V}{6}$

in which R = resistance in pounds per ton (2,000 pounds) on straight level track and V = velocity in miles per hour.

Under good conditions the drawbar pull necessary to haul one ton varies from 6 to 8 pounds on straight level track, increasing with curves and grades. The increased resistance due to grades is as follows: One mile contains 5,280 feet, and the force necessary to move one ton up a grade of one foot per mile is .3788 pounds. When the grade is expressed in feet per mile the number of feet per mile multiplied by .3788 will give the resistance in pounds per ton. When the grade is expressed in feet per hundred, or per cent, the resistance for each per cent of grade will be 20 pounds per ton. The resistance due to curves is not easily determined. The construction of the roadbed, speed of train and various other conditions of service make it impossible to give an exact rule for computing the resistance due to curves of any given radius. This resistance has been estimated at from .6 to .7 pounds per ton per degree of curve. By degree of curve is meant the number of degrees of central angle subtended by a chord of 100 feet. One degree of curvature equals a radius of 5,730 feet. Therefore, the number of degrees divided into 5,730 gives the radius in feet to a very close approximation.

A starting force of about 18 pounds per ton is necessary to overcome train resistance. However, considerable variation from this force is likely to be experienced. Values mentioned by numerous authorities range from 14 to 30 pounds per ton. These figures are not intended to cover inertia but represent slow starts. The resistance reduces the instant the train moves. Slack in couplers or compression in draft springs aid the locomotive by permitting the train to start one car at a time. Engineers realize this and locomotives draw trains with entire satisfaction which if all the cars in the train were rigidly coupled could not be started. The effect of wind resistance is of such importance that consideration should be given the same. Winds blowing with the train help the locomotive while head-on winds add to the resistance to be overcome by the locomotive. Winds at right angles to the direction of travel of the train are, as a rule, considerably harder on the locomotive than head winds. The side wind causes high flange friction on the far side and it is not uncommon during heavy wind storms on the prairies to have trains delayed as the locomotives are unable to maintain their scheduled speed.

Trains in starting will require, as stated above, about 18 pounds per ton and as the speed increases to five miles per hour will drop to four or five pounds per ton. The formulæ as hereinbefore given for determining the value of R, or draw bar pull, are not general. We know that R does not increase at the same rate for heavy trains as for lighter trains. For a 100-ton train 30 pounds per ton will be the approximate tractive effort when the speed is 80 miles per hour and for a 600-ton train 15 pounds per ton at the same speed will be required.

Inertia.— Inertia, the amount of which depends upon the weight and change in velocity, effects all bodies in motion. Locomotives move on the track at varying speeds, some of the parts have various speeds with respect to each other and the motions of the parts are in different directions. The locomotive must be built to withstand these inertia forces safely. The inertia forces are small when the speed is low, but should nevertheless be given careful consideration. At high speeds many failures have resulted due to improper size of the parts. For instance, a locomotive running at 60 miles per hour has its brakes applied as it approaches a curve. It is obvious that the locomotive must be built to withstand the inertia forces and be balanced to resist the tendency to overturn as curves are met.

Economy of Modern Locomotives.— Tests reported (Bulletin No. 26, University of Illinois Experiment Station) show the following increase in economy with increase in boiler pressure:

Boiler pressure, lbs. per sq. in.	120	140	160	180	200	220	240
Steam per I. H. P. per hr. in lbs.	29.1	27.7	26.6	26.0	25.5	25.1	24.7
Coal per I. H. P. per hr. in lbs.	4.0	3.8	3.6	3.5	3.4	3.4	3.3

In *Engineering News*, 8 March 1894, Mr. C. H. Quereau reports that the mean effective pressure decreases as the speed of the locomotive increases:

Miles per hour	46	51	53	54	57	60	66
Revolutions per minute	224	248	258	263	277	292	321
Mean effective pressure, lbs. per sq. in.	51.5	44.0	43.0	41.3	42.5	37.3	36.3

Mr. Quereau also states the following relative to the variation of steam consumption with speed:

TWO-CYLINDER COMPOUND			SINGLE EXPANSION		
Revolutions	Miles per hour	Steam per I. H. P. per hour in lbs.	Revolutions	Miles per hour	Steam per I. H. P. per hour in lbs.
100–150	21–31	18.33	151	31	21.7
150–200	31–41	18.9	219	45	20.91
200–250	41–51	19.7	253	52	20.52
250–275	51–56	21.4	307	63	20.23
......	......	......	321	66	20.01

The maximum indicated horse power per square foot of grate surface lies, for the freight locomotives, between 21.1 and 31.2. for passenger locomotives between 28.1 and 35.0.

Cylinder Performance.— Cylinder performance is affected by variation in both speed and cut-off. Run at a constant speed, the steam consumption per indicated horse power in simple locomotives is a minimum at from 30 to 40 per cent cut-off, increasing at either earlier or later cut-offs. When run at constant cut-off, the steam consumption decreases rapidly with the speed until it reaches a minimum at a speed of approximately 150 revolutions per minute, and then increases as the speed increases beyond this point.

SPEED		DRY STEAM PER I.H.P. PER HOUR, LBS.			
R.P.M.	Miles per hour	Per cent cut-off —50	20	40	30
40	6⅔	30.0	28.8	28.0	27.4
60	10	27.5	26.8	25.9	25.1
80	13⅓	26.0	25.5	24.6	24.0
100	16⅔	25.5	24.9	24.0	23.6
120	20	25.6	24.5	23.8	23.3
140	23⅓	26.0	24.5	24.0	23.3
160	26⅔	......	24.7	......	23.5
180	30	......	25.0	......	....
200	33⅓	......	25.5	......	....

The preceding table gives typical performances for a simple freight locomotive operating at 200 pounds pressure.

Boiler Performance.— The evaporation per square foot of heating surface per hour varies from 5 to 15 pounds. Under ordinary conditions the evaporation is about 11 pounds per hour and the locomotive is seldom driven above this amount. Under the conditions of service prevailing it will average nearer 7. Therefore each square foot on the average will be good for about .2 of a boiler horse power and when driven will supply around .4 B.H.P. Slightly less than one-half of the evaporation takes place on the heating surface of the firebox although it constitutes between 4 and 8 per cent of the total heating surface. Most of the heating surface is in the tubes.

Evaporation results in ordinary practice will as a rule fall between the values given in the following table:

Water evaporated per lb. of dried coal as fired	Waters evaporated per sq. ft. of heating surface per hour in lbs.
8.0 to 11.5	3
7.7 to 11.1	4
7.5 to 10.7	5
7.2 to 10.2	6
7.0 to 9.8	7
6.8 to 9.4	8
6.5 to 9.0	9
6.2 to 8.5	10
6.0 to 8.1	11
5.8 to 7.7	12
5.5 to 7.2	13
5.2 to 6.8	14
5.0 to 6.4	15

Compound Locomotives.—Any locomotive equipped with cylinders in which the expansion of steam is begun in one cylinder and continued in another is called a compound locomotive. When steam is expanded in two or more cylinders successively the number of expansions per cylinder is less than when only one is used, and therefore the range of temperature in each cylinder is less. Reducing the range of temperature in each cylinder reduces the condensation losses. The main object of compounding is to reduce the amount of steam per horse power per hour. With compound engines as applied to locomotives the saving in steam consumption as compared with simple engines is a very uncertain quantity. Ten to 20 per cent less steam is used per indicated horse power per hour in compound locomotives than in the simple engine when the cylinders, pistons and valves are all in good condition.

Locomotives with more than two cylinders are as a rule made compound. In two-cylinder compounds it is quite important that the work done in each cylinder be equal. The exhaust or back pressure of the high pressure cylinder is the initial pressure of the low pressure cylinder. They are arranged, however, to start as simple engines and the general arrangement is to allow the high pressure cylinder to exhaust directly into the atmosphere, the steam from the boiler to the low pressure cylinder being reduced in pressure by passing through a reducing valve.

Under ordinary conditions the cylinder performance of compound locomotives as compared with simple locomotives is as given in the following table:

SPEED IN R. P. M.	LBS. OF DRY STEAM PER I.H.P. PER HOUR Simple locomotives	 Compound locomotives
40	27.3 to 30.0	20.3 to 22.0
60	26.0 to 27.9	20.1 to 21.7
80	24.9 to 26.3	19.9 to 21.6
100	24.0 to 25.3	19.8 to 21.4
120	23.7 to 24.8	19.8 to 21.5
140	23.6 to 24.7	20.0 to 21.7
160	23.7 to 24.8	20.2 to 22.0
180	24.0 to 25.2	20.6 to 22.3
200	24.5 to 25.9	21.0 to 23.0
220	25.7 to 27.0	21.4 to 23.8
240	26.7 to 28.2	22.0 to 24.6
260	27.7 to 29.2	22.8 to 25.5

Geared Locomotives.— Geared locomotives are especially designed for logging service, where steep grades, sharp curves and uneven tracks are encountered. They are carried on 8 or 12 wheels, which are grouped in two or three trucks; each truck having four wheels. Power is applied to all the wheels, in order that the whole weight of the locomotive, including the fuel and water supply, is available for adhesion. As a general rule the engine drives a transverse shaft. The transverse shaft is bevel gear connected to longitudinal shafts which extend to the trucks. Universal joints are arranged as fitted to the longitudinal shafts to compensate relatively changing positions of the trucks when the engine is traversing curves.

The trucks are so arranged that the boxes can play in their respective pedestals without throwing the gears out of mesh. In case it is desired to transport the locomotive on its own wheels the gears can be thrown out of mesh so that the transmission mechanism does not act when the locomotive is moved.

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LOCOMOTIVE, Principal Parts of.— The following list embodies brief descriptions of the construction and operation of the various principal parts of the modern locomotive. For further information consult articles under the titles Locomotive; Locomotive Industry; Engine Industry in this Encyclopedia.

Air Bell-ringer.— Air-pressure connection for ringing the signal bell.

Air-brake Hose.— The flexible hose connection by which the brake-pipe of the locomotive is attached to that of another locomotive.

Air-cylinder of Brake-pump.— The lower cylinder of the air-pump which furnishes the compressed-air for setting the air-brakes.

Air-drum.— The main air-reservoir. See Main Reservoir.

Air-gauge.— A pressure gauge provided with two hands, one of which indicates the amount of air-pressure in the main reservoir, and the other one the pressure in the main brake-pipe or train-pipe. In the latter the pressure is usually maintained at 70 pounds as indicated by the gauge, and in the main reservoir somewhat in excess of this amount, so as to ensure the proper action of the valves of the air-pump.

Air-pump.— An air-compressing pump which is worked by steam taken from the boiler. It supplies the compressed-air used for operating the air-brakes, and for signal purposes.

Air-pump Exhaust-pipe.— The pipe from the steam cylinder of the air-pump to the steam-pipes in the smoke-box.

Air-pump Lubricator.— The cup or arrangement which contains the oil used in lubricating the air-pump. It is located in the cab.

Air Signal-hose.— The flexible hose which connects the air signal-pipe in the cab with the air signal-pipe connections in the cars.

Apron.— The sheet-iron plate which covers the space between the locomotive and the tender.

Arch-pipes.— The steam-pipes in the smoke box which connect the branches of the T-pipe with the steam-chests.

Bell-yoke or Bell-stand.— The cast-iron arch placed upon the top of the boiler, in which the bell is swung.

Bissel-truck.— A wheel arrangement or truck designed to relieve the lateral rigidity in locomotives, and facilitate their travel around curves.

Blow-off Cock.— A plug-cock at the bottom of the fire-box, by the opening of which the boiler is blown off or emptied.

Blower-pipe.— The pipe in the smoke-box connected with the blower-cock in the cab. By blowing steam through it, a draft is produced when the locomotive is at rest.

Boiler.— The large sheet-iron cylindrical structure, constituting the main upper body of a locomotive, filled with tubes, in which the steam used for driving the locomotive and operating its various auxiliary appliances is generated.

Boiler-jacket.— See Jacket.

Bonnet.— The wire cap or netting placed over the smoke-stack to restrain the sparks and cinders.

Boxes.— The bearings which rest upon the journals of the axles.

Brake.— The appliance by which a locomotive or a train is brought quickly to a standstill. Ordinarily, it consists of a flexible piece of strap-iron lined with wooden blocking which is applied to the tires of the wheels by means of rods and levers actuated by the pressure of compressed-air, or by hand.

Brake-pipe.— The pipe through which compressed-air is conducted from the various air-reservoirs connected with the air-pump, to the brake-cylinders of the locomotive, the tender, and the cars composing the train. Each car has its own brake-pipe and brake-cylinder. When the cars are made up into a train, these pipes are connected with each other and with those of the tender and the locomotive, by means of flexible hose, and when thus connected, it is called the train-pipe.

Brasses.— The brass boxes on the cross-heads and the crank-pins.

Bumper Blocks.— Pieces of timber bolted to the bumpers for the purpose of reducing the shock of impact when the cars come together.

Bumper Sheet.— A sheet of metal placed on the front end of the frame, to cover the space between the bumper and the cylinders.

Bumpers or Buffers.— Massive pieces of timber bolted to the front end of the engine frame, and to the rear end of the tender to receive "bumps" without fracturing the metal behind.

Cab.— The hood or house placed on the back end of the boiler, and over the foot-plate, for occupancy by the engineer and fireman.

Cab Handles.— Handles attached to the sides of the cab for the use of the engineer and fireman, in getting on or off the engine.

Cellars.— Recesses or chambers in the jaws of the boxes, which hold the oil for lubricating the journals.

Centre-casting.— The cast-iron plate which connects the truck bolster to the front-end of the boiler.

Check-chamber.— A chamber attached to the waist of the boiler, through which the water passes from the connecting pipe to the boiler.

Check-valve.— A wing-valve inserted in the feed-pipe between the feed-pump and the boiler, to prevent the return of the water from the boiler to the pump.

Connecting-rods.— The rods or bars attached to the piston-rods, by means of which the power developed in the cylinders is transmitted to the driving-axles. They convert the rectilinear reciprocating motion of the pistons into the rotary motion of the crank-pins of the main driving wheels.

Counter-balances or **Counter-weights.**— Large blocks of iron cast on or otherwise secured in place between two or more spokes of each driving-wheel, opposite the crank-pin, for the purpose of balancing the weight of the parallel and connecting rods, and to steady the motion of the engine by equalizing the forces or moments around the axle.

Coupler.— See Draw-bar.

Coupling-rods.— The rods by which the crank-pins on adjoining driving-wheels are connected together, so as to cause the wheels to rotate in unison.

Cow-catcher or **Pilot.**— A triangular structure of steel, or iron bars, or curved sheet-metal, attached to the front end of the locomotive. It is provided for the purpose of removing stray cattle and other obstructions from the track, and thus prevent them from getting under the wheels.

Crank-pin.— A pin in the crank of a driving wheel uniting the connecting-rod with the driver.

Cross-heads.— Blocks, which move in guides and unite the piston and connecting-rods, and slide-blocks together.

Crown-bars.— Bars placed on the upper side of the crown-sheet in the water-space, with their ends resting on the edge of the furnace-sheet, to strengthen the crown-sheet.

Crown-sheet.— The top sheet of the furnace, to which the crown-bars are attached. It is placed directly over the fire.

Cut-off.— The termination of the period of admission of steam into the cylinders. The point of cut-off is regulated by the amount of lap on the slide-valves.

Cylinders.— Steam-tight, cylindrical, metal receivers attached to the front end of the boiler on each side of the lower part of the smoke-box. They contain the pistons, which are actuated by the steam obtained from the boiler. There may be two, four or eight of them, according to the type of locomotive — simple-engine, compound-engine and tandem-compound engine, respectively. They are called high-pressure or low-pressure cylinders, according to the manner in which the expansive energy of the steam is utilized therein, and are given the additional designations — outside or inside cylinders, according to their position relative to the engine frame.

Cylinder-cocks.— Small cocks placed on the lower parts of cylinder-heads, to drain off water of condensation.

Cylinder-heads.— The front and back ends of the cylinders. The latter hold the stuffing-boxes through which the piston-rods move.

Dampers.— The doors in the front and rear ends of the ash pan, by which the air admitted to the furnace is regulated.

Dashers.— The sheet-iron plates attached to the inside shell of the boiler, opposite the pump-check, to prevent the cold water from drenching the tubes.

Deflector.— A bell-shaped or trumpet-mouthed opening used in the furnace to effect a mixing of the air and gases so as to cause the latter to ignite and thus render the combustion of the fuel more perfect.

Dome-bodies.— The sheet-iron jackets which envelop the dome outside of the wooden "lagging."

Dome-stays.— The braces attached to the crown-bars and the dome, to strengthen the dome and the crown-sheet.

Dome or **Steam-dome.**— The elevated, dome-shaped chamber on the top of the boiler, from which the supply of steam for the cylinder is taken, because it is partially superheated.

Draw-bar or **Coupler.**— The bar attached to the front of the pilot, by means of which the locomotive may be attached to cars or to another locomotive. The name is also applied to the rod or bar by which the locomotive is coupled to its tender.

Drip-cock or **Drip.**— The receptacle placed under the gauge-cocks, to receive the water and steam discharged.

Driving-axles.— The axles which communicate the motion of the connecting-rods directly to the driving-wheels.

Driving-saddles.— The yokes which straddle the frame and support the driving-springs.

Driving-wheels or **Drivers.**— The wheels which are attached to the driving axles. The driving-wheel arrangement of a locomotive may consist of the 4-coupled, 6-coupled, etc., wheel type. They form what is called the "wheelbase" of the locomotive. The tractive power of a locomotive is derived from the adhesion of the driving-wheels to the rails, and depends upon the weight of the locomotive and the area of the wheelbase.

Eccentric.— A device for operating the slide-valves. This change in motion is effected by giving the eccentric a definite "throw" or eccentricity equal in amount to one-half of the travel of the valve. A locomotive has two pairs of eccentrics and their attachments. One eccentric of each pair is set on the shaft in such a position that the operation of the valves will run the engine in one direction, and the other one is set so as to operate the valve to run the engine in the opposite direction. The ends of each pair of eccentrics are attached to a link by means of which either of the eccentric-rods is engaged with or disengaged from the rockers.

Eccentric-sheave.— The body of the eccentric or the eccentric itself, which is forged or keyed directly on to the axle or crank-shaft.

Engineer's Brake-valve.— The air-valve arrangement located on the right side of the cab, by means of which the engineer operates the driving-wheel and other brakes on the locomotive, and also the several sets of air-brakes attached to the cars of the train.

Engine-truck.— See Truck.

Equalizing-levers.— Bars suspended at their middle points underneath the engine-frame, and connected at their ends to the springs of the driving-wheels, for distributing the force of the shocks.

Equalizing-springs.— The spiral or elliptical springs on the reverse-shaft, provided for the purpose of equalizing the weight of the links.

Exhaust-port.— The middle opening in the seat of each slide-valve.

Expansion-clamps.— The clamps bolted over the main-frames and the furnace-pads, to allow for the expansion of the boiler under the influence of heat. Also, the clamps bolted to the fire-box under the main-frame to hold the latter against the liners.

Feed-pipe.— The pipe which conveys the feed water from the feed-pump to the boiler. See Injector.

Feed-pump.— The force pump which supplies the boiler with feed-water. It forces the water into the boiler against the pressure in the boiler. See Injector.

Feed-tank.— The water tank provided for the purpose of holding the feed-water for the boiler. It is located in the tender.

Feed-water.— The water used for the supply of the boiler.

Fire-box.— The furnace, or that part of the boiler, in which the fuel is burned.

Fire-door.— The door in the back end of the boiler, through which the fuel and the firing irons are introduced into the fire-box.

Flues.— The pipes in the boiler which carry off the smoke and the waste-gases from the fire-box to the smoke-box, and thus produce the draft necessary for the combustion of the fuel. They are made of iron, the diameter of the tubes being kept as small as possible so as to subdivide the volume of the smoke and gases into a large number of small streams, thus exposing them to a large radiating surface, through the medium of which the heat is transmitted to the water surrounding the tubes.

Follower-plates.— The plates which cover the spring-packing on the front ends of the piston-heads.

Foot-board.— A platform on the back end of the boiler, on which the engineer stands.

Foot-plate.— A cast-iron plate bolted to the back end of the frame opposite the fire-door.

Frame.— The strong metal skeleton which supports the boiler, machinery, and axles of the locomotive.

Frame-splice.— The connecting arrangement between the front and main frames.

Front-end.— That part of the locomotive which includes the extended outer-shell of the boiler, comprising the smoke-box and all of the appliances contained therein, such as steam and exhaust pipes, nettings, diaphragms, draft-pipes and the base of the smoke-stack. The function of the front-end is to draw atmospheric air into the ash-pan, and thence through the grate and the fire-box, and to draw the furnace gases through the flues, and thence under the diaphragm into the smoke-stack, and force them out into the atmosphere.

Front-rail.— A single-bar attachment which extends from the front of each of the main frames to the front bumper.

Frost-cocks.— Cocks provided for the purpose of admitting steam from the boiler to the feed-pipes, to prevent them from freezing in cold weather.

Frost-plugs.— Plugs screwed into the pump chambers and pump cages to allow the water to drain out and prevent them from freezing.

Furnace-pads.— The knees bolted on the shell of the fire-box, to place the weight of the boiler on the frame.

Furnace-rings.— The wrought-iron rings which connect the outside and inside sheets in the water space at the bottom of the furnace.

Gib.— The fixed wedge employed to compensate the wear in the boxes, on the cross-heads, and of the crank-pins.

Gland.— A bush by means of which the packing in the stuffing boxes is secured in place, to receive the wear of the piston-rod, and to prevent the leakage of steam.

Goose-neck.— A bent pipe of brass, or iron, employed to connect the front end of the feed-pipe with the lower chamber of the pump.

Governor or Pump-governor.— A valve arrangement connected with the steam pipe and the brake-pipe or train-pipe attached to the air-pump. It is employed to regulate the action of the pump in operating the air-brakes. It is usually set to maintain a pressure of 70 pounds as indicated by the air-gauge.

Grate.— The area made up of the grate bars in the fire-box, on which the fuel is burned.

Grate Shaking-rig.— A bar attached to the movable grate-bars of shaking or rocking grates, by which they are moved back and forth with a rocking motion, thus disturbing the fire over the whole area of the grate, to effect proper combustion. It is operated by means of a suitable lever placed in the cab.

Guide-bars.— The parallel bars between which the cross-heads move, thus giving a perfectly horizontal motion to the piston-rods. They may consist of two parallel bars, double-guides or a single guide-bar, attached to the back head of the cylinder and to a support called the guide-yoke, a strong plate usually fastened to both the frame and the boiler, and placed across the frame at a point well forward of the front driving-wheels.

Guide-blocks.— The blocks on the back-head of the cylinders, and on the guide-yoke, to which the guide-bars are attached.

Hand-holes.— Openings provided in the outside shell of the furnace near the ring, through which deposits of rust or dirt in the water-legs of the furnace are removed.

Hand-rails.— Brass or iron pipes attached by brackets or studs to the upper part of the boiler, and extending from the cab to the smoke-box. They are used by the engineer in getting on or off the running-board.

Headlight.— A large light placed on the front end of the locomotive to illuminate the track in front and thus disclose any obstructions that may exist thereon, and to signal the approach of the locomotive.

Heater-cocks.— Cocks attached to the back end of the boiler, by which steam is blown through the feed-pipes, to prevent them from freezing in cold weather.

Hollow-stays.— Hollow stay-bolts inserted through the inside and outside sheets of the furnace near the crown-sheet, through which air is admitted to the furnace to increase the combustion.

House.— See Cab.

Induction-ports.— The passages in the valve-seats, through which steam is admitted to the cylinders. See Steam-ports.

Injector.— A mechanical device by means of which a continuous supply of feed-water is given to the boiler. Partial condensation of the steam is essential to efficient action. The injector will not feed water too hot to condense the steam.

Jacket.— The outside coverings of the cylinders and the boiler. The boiler jacket is composed of layers of wood called "lagging" about seven-eighths of an inch in thickness, felt, and iron, placed around the boiler to prevent the loss of heat by raidation and convection.

Jam-nuts.— Lock-nuts used for setting-out the spring-packing in the piston-heads.

Jaws.— The parts of the frame formed by the frame-legs, and which hold the axle-boxes.

Journals.— That part of the axle on which the weight of the locomotive rests. The journals are situated on the inner side of the wheels, and turn on brass "journal-bearings" which resists the friction of the axle. The bearings are held in cast-iron or steel boxes called "journal-boxes" or "axle-boxes."

Keys.— The wedges employed to tighten the "straps" which hold the "brasses" at the ends of the connecting-rods.

King-bolt or Centre-pin.— The bolt or pin which passes through the centre-casting and the centre of the truck, thus making a flexible connection between the engine and the truck, enabling the latter to turn about the king-bolt so as to allow the axles to assume positions approximating the radii of the curves of the track.

Knuckle-joints.— The joints on the valve-rods, which allow the rods to vibrate freely with the radius of the rocker-arm.

Link.— A variable-radius expansion-gear by means of which the slide-valves are operated. See Eccentric.

Link-block.— A block which fits into the curved slot of the link, and moves freely from one end to the other thereof.

Link-hangers.— Rods or bars by which the links are suspended to the horizontal arms of the lifting-shaft.

Lubricator.— The valve through which oil or tallow is admitted to the cylinders for the purpose of lubrication.

Main Reservoir.— The main air-reservoir of the locomotive. It is usually located on the front of the main frame, and immediately behind the cylinders.

Main-rods.— See Connecting-rods.

Mud-drum.— A cylinder attached to the under side of the "waist" of the boiler, to receive the deposits from the feed-water. This material is discharged from the drum by means of a valve called the "mud-cock."

Mud-holes.— Openings provided in the back end of the fire-box, through which the accumulations of mud in the lower water-space are removed. These openings are usually closed by means of brass plugs.

Mud-ring.— The wrought-iron ring which unites the inner and outer shells of the fire-box; completely surrounding the inner shell and closing the water space between the two shells.

Netting.— Wire netting placed in the front end of the smoke-box, and in the smoke-stack. This netting acts as a sieve, arresting the sparks and cinders, but allowing the smoke to escape.

Oil-cups.— Cylindrical metal receptacles with glass linings, employed to contain oil, and to distribute it to moving contact surfaces, for the purpose of lubricating them.

Packing.— The hempen, metallic or other substance used in the stuffing-boxes, and in the steam and pump cylinders, to make the moving parts of the pistons steam and water tight.

Petticoat or Draft Pipe.— The pipe through which the exhaust-steam is conducted to the exhaust-nozzles in the smoke-box, thus creating a partial vacuum in the smoke-box, which sucks the smoke and gases out of the flues with great power, and forces them out into the open air by the blast or the action of the exhaust steam.

Pilot.— See Cow-catcher.

Piston-head.— The disc-like plunger in the cylinder which is moved with a reciprocating movement by the steam, converting the energy of the steam into motion.

Piston-rod.— The rod attached to the piston-head, and by means of which the motion of the piston-head is communicated to the connecting-rod or crank.

Primer.— The valve by means of which the air in the water-space of the pump is expelled, and a partial vacuum produced so as to cause an inflow of water to start the action of the pump.

Quadrant.— A slotted curved bar which holds the reverse-lever in the proper position by means of a reverse-latch. Also, a toothed bar located in the cab, by means of which the variable exhaust is regulated.

Radius-bar.— The angle-bar attached to the back end of the truck frame and to the radius-bar cross-tie by means of a pin.

Reach-rod.— The rod which connects the reverse-lever with the reverse-arm of the reverse-shaft.

Reverse-latch.— The tongue which fits into the notch of the quadrant by which the reverse-lever is held in the right position.

Reverse-lever or Reversing-lever.— The lever by which the direction of motion of the locomotive can be changed, and the travel of the valves increased or decreased. It is located in the cab within easy reach of the engineer.

Rockers.— The double-cranks connected with the link-blocks at one end and the valve-rods at the other, and through which the valves receive the motion of the eccentrics and links.

Saddle-pin.— A pin by which the link-hangers are attached to the saddle-plate, and by means of which the link is raised or lowered.

Saddle-plate.— The plate which fits into and slides in the slot of the link.

Safety-hangers.— Chains fastened to the front-bumper and to the front end of the truck-frame, to prevent the truck from swinging around and breaking the links in case the locomotive happened to run off the track.

Safety-valves.— Spring-valves attached to the dome-cover, by which the steam-pressure in the boiler is prevented from exceeding a certain limit.

Sand-box.— The cylindrical or dome-shaped box attached to the top of the boiler to contain the sand used for the purpose of sanding the rails in order to increase the adhesion, and prevent the driving-wheels from slipping at starting, or when hauling a heavy load, or when running up a heavy grade.

Sand-pipes.— The pipes on each side of the locomotive through which the sand from the sand-box is conveyed to the rails in front of the driving-wheels.

Side-rods or Parallel-rods.— See Coupling-rods.

Sight-feed Lubricator.— See Lubricator.

Signal-pipe.— The air-pressure pipe by means of which the engineer communicates with the trainmen.

Signal-whistle.— A steam-whistle attached to the top of the dome. It consists of an inverted metal cup, usually made of brass, which is placed immediately over the annular opening of a hollow valve-stem screwed into the top of the dome.

Slide-valves.— The valves which control the admission and exhaust of steam to and from the cylinders.

Smoke-box.— A cylindrical chamber at the front end of the boiler, which is utilized to contain the arch-pipes, lifting-pipes, exhaust-pots, exhaust-nozzles, steam-pipes and exhaust-pipes. It also forms a convenient receptacle for the smoke before it escapes into the open air through the smoke-stack.

Smoke-stack.— The chimney through which the smoke escapes from the smoke-box.

Springs.— Bundles of steel plates placed one on top of the other and bound together at the middle by metal bands, and their end connected to the equalizing beams, for the purpose of reducing the effects of the shocks delivered to the locomotive by inequalities in the smoothness of the track. In order to place the weight of the locomotive on the axle-boxes of the driving-wheels, the axle-boxes are arranged to slide up and down in the jaws formed by the legs of the frames, and the springs are placed on saddles which rest on top of the axle-boxes.

Spring-balances.— The spring attachments in the cab which connect the safety-valve levers to the top-sheets of the boiler.

Stack-base.— The lower part of the smoke-stack, by which the stack is attached to the top of the smoke-box. In some forms it is provided with a hand-hole through which the accumulation of sparks may be conveniently removed.

Stand-pipe.— See Steam-pipe.

Stay-bolts.— The bolts screwed through the inner and outer shells of the fire-box at frequent intervals, usually about four and a half inches apart, to connect the shells together and enable them to resist the full pressure of the steam.

Steam-chests.— The boxes located on top of the cylinders, and which contain the slide-valves through which the steam is admitted to the cylinders.

Steam-gauge.— A gauge attached to the back end of the boiler, in the cab, to indicate the pressure of steam per square inch in the boiler.

Steam-pipe.— Any pipe carrying steam, but especially the pipe through which steam is conducted from the boiler to the steam-chests, thence through the openings in the seats of the slide-valves to the cylinders. Starting at the dome, the pipe makes a bend called the throttle-pipe; then it extends vertically downwards until it clears the vertical walls of the dome, this vertical part is called the stand-pipe. The stand-pipe is connected to the dry-pipe which extends to the top of the smoke-box where it is connected to the T-pipe, the branches of which are connected to the arch-pipes or steam-pipes connecting with the steam-chests.

Steam-port.— A port or passage in a slide-valve for admission of steam.

Steam-valve.— The valve inserted in the steam-pipe connecting the boiler with the injector.

Stuffing-boxes.— The chambers in the back-heads of the cylinders, through which the piston-rods move.

Supply-ports.— The openings in the steam-chests through which the steam is admitted from the steam-pipes.

Swing-bolster.— A swinging bearing in the centre of the truck on which the forward end of the locomotive rests, and which enables it to make curves easily.

T or Nigger Head.— See Steam Pipe.

Tender.— The carriage coupled to the back end of the locomotive, and used for the purpose of carrying water and fuel.

Throttle.— The double poppet-valve or throttle-valve, placed in the throttle-pipe near the top of the dome. This valve is operated by the engineer by means of a lever called the throttle-lever located in the cab, and connected by a rod called the throttle-stem to the lower arm of a bell-crank called the throttle bell-crank, the other arm of which is connected by a rod to the throttle-valve.

Tires.— The steel bands which form the peripheries of the driving-wheels.

Trailing-wheels.— The back pair of driving-wheels in a four-coupled wheel arrangement, or a small pair of wheels placed behind the main driving-wheels where only one pair of driving-wheels is employed.

Train-pipe.— See Brake-pipe.

Truck-brake.— The air-brake equipment of the truck, as distinguished from the air-brake equipment of the driving-wheels.

Truck or Engine-truck.— The frames, wheels, springs, swing-bolsters, etc., which support the weight of the front of the locomotive.

Tubes.— Pipes for the passage of water. Compare flues.

Tube-sheets.— The plates at the front and back ends of the boiler in which the tubes are inserted.

Tumbling Shaft.— See Lifting Shaft.

Valve Ports.— See Slide-valve.

Valve-yokes.— The wrought-iron or steel bands placed around the slide-valves in the steam-chests, and to which the valve-stems are attached.

Waist.— The cylindrical portion of the boiler.

Waist Sheet.— A sheet of wrought-iron bolted to the waist by an angle-iron, to which the guide-braces, guide-bearers and cross-ties are attached.

Water-pipe.— The pipe to which the feed-pipe hose is connected.

Water-tubes.— Any tubes carrying water, as the iron tubes, about two inches in outside diameter, which are attached to the front and back ends of the fire-box at such an inclination as to allow a continual circulation of water through them to keep them cool and thus prevent them from being burned out by the intense heat.

Water-valve.— See Injector.

Whistle-rig.— See Signal Whistle.

LOCOMOTIVE DEVICES. See Safety Devices.

LOCOMOTIVE ENGINE, The. See Locomotive.

LOCOMOTIVE INDUSTRY, The. Unlike many of the great American industries the history of the inception and growth of locomotive engineering in the United States may be clearly traced from the day when the first locomotive was run upon the rails of the Baltimore and Ohio Railroad. Other lines of rails had previously been laid but they had been constructed for special purposes, and it was not until 1828, when both the Baltimore and Ohio and the South Carolina railroads were started, that there was any system constructed with the definite object of conveying both passengers and freight. The first American built locomotive was operated upon the Baltimore and Ohio tracks, and although it was nothing more than the mere working model which was constructed by Peter Cooper in 1829, and was not intended for permanent service, it demonstrated the practicability of the invention so conclusively as to prove to the world that railway lines might be operated by locomotive power. In fact, it was largely due to this successful demonstration that the road was finally completed. If the experiment had failed, the project would have been abandoned.

The Peter Cooper model was a little engine with a single cylinder three and a half inches in diameter, with a boiler that was scarcely larger than that of an ordinary kitchen range, and with tubes that were improvised from gun-barrels. In spite of all the crudities in its construction, however, its trial run was completed so successfully that Peter Cooper, who himself was the engineer, was able to drive his locomotive, which hauled 41 persons, including himself, at a speed of 18 miles an hour. Slight as such speed would seem at the present time, it was a great achievement for those days, when the locomotive was so generally regarded as the dream of an impracticable visionary. Moreover, it meant the beginning of the great development of the American locomotive and engine industry.

The first locomotive to be constructed in the United States for actual work was made in 1830. In 1829, however, Horatio Allen had imported a locomotive from Stourbridge, England, for the use of the Delaware and Hudson Canal Company. It was known as the «Stourbridge Lion,» and was the first «real» locomotive ever used in this country. The first distinctively American locomotive, the «Best Friend,» was manufactured to the order of the South Carolina Railroad by the West Point Foundry. Both of these machines were operated successfully.

It was in 1831 that Matthias W. Baldwin, a manufacturer of bookbinders' tools in Philadelphia, was employed by the proprietors of Peale's Museum, in that city, to construct a model locomotive for exhibition purposes. This was the time when the public excitement over the Rainhill contests that had been held in England was at its height, and Robert Stephenson's victory with his «Rocket» had made the people very curious to witness the operations of such an engine. To gratify this craving for novelty the museum managers built a circular track, and, upon this, the Baldwin locomotive was operated. His model worked so well that the officials of the Philadelphia, Germantown and Norristown Railroad Company engaged him to construct a larger machine for use upon their lines. This locomotive, which was completed in November 1832, was named «Old Ironsides.» It was a four-wheeled engine, very similar in design to that of the English make, and weighed, when placed on the tracks, a little more than five tons. The rear, or driving wheels, which were 54 inches in diameter, were placed on a crank axle; while the cylinders, which were nine and a half inches in diameter, by 18 stroke, were attached horizontally to the smoke box. The frame was made of wood, while its wheels, which had wooden spokes and rims, were strengthened by the wrought-iron tires and heavy cast-iron hubs. There was no cab, and the tender, which also ran on four wheels, had wooden sides and back to hold the wood that was required for fuel, and an iron tank, used for carrying water. Roughly made as this locomotive would seem if compared to the engines of this day, the speed which it was able to attain, with its train of cars attached, was frequently over 30 miles an hour. In September 1832, the firm of Davis and Gartner of York, Pa., built three locomotives of the «grasshopper» type for the use of the Baltimore and Ohio Railroad. They were made from designs prepared by Phineas Davis and Ross Winans, and were so serviceable that several of them were in use for fully 60 years. Thus, step by step, the locomotive industry was developed. By 1834, the building of such engines had extended to many works in several parts of the country, and such pioneers of railway mechanics as Cooper, Allen, Baldwin, Rogers, Norris, Winans, Campbell and others paved the way for the greater achievements of Mason, Cooke, Milholland, McQueen and Hudson, to say nothing of the countless geniuses whose accomplishments represent the modern development of the art of engine building. In the old days, of course, there was no guide that anybody could follow. There was no such teacher as experience. Moreover as there were few skilled workmen, and practically no shop facilities, the pioneer locomotive builders labored under difficulties which make their success remarkable as the extraordinary achievement of indomitable perseverance.

The early American locomotives were so similar in every essential feature to the engines of English make that it seems quite probable that they were constructed as a close copy of that model. Later, however, the American inventive genius came to the front, exhibiting itself in such radical departures from the imported machines that it was no longer necessary to bring locomotives from Europe. Taking these evidences of development the improvements upon the locomotives of English type were reached in about the following order: The four-wheel swiveling truck, or bogie, was substituted for the pair of fixed carrying wheels in 1832; the cross-head pump for supplying feed water to the boiler was invented in 1833; the half-crank driving axle took the place of the crank-axle in 1834; outside connection to the driving wheels was introduced in 1835; the coupling of two pairs of driving-wheels was patented by H. R. Campbell in 1836; counterbalance weights for the revolving and reciprocating parts were first used in 1837; equalizing beams connecting the driving springs were first applied by Eastwick and Harrison in the same year; the use of lap-welded wrought-iron boiler tubes first took place in 1838; and of bar-frames of forged iron with forged pedestals, in 1840; the wooden cabs with glass windows originated during the winter of 1840–41, having been invented in New England, where the excessively cold weather necessitated some such protection for the enginemen; the Baldwin flexible-beam truck was invented in 1842; the first «ten-wheel» locomotive, with six coupled wheels and a leading four-wheeled truck, was used in 1846; the Mogul locomotive, with six coupled wheels and a leading two-wheeled truck, came into use in 1861, while the Consolidation type, consisting of eight coupled wheels and a leading two-wheeled truck, an engine which was designed by Alexander Mitchell of the Lehigh Valley Railroad, was first built at the Baldwin Locomotive Works in 1866. Among the other features of the locomotive which have been added from time to time, and all of which appealed to the eye of the foreign manufacturer as peculiarly American inventions, are the pilot, or «cow-catcher,» the bell, the boiler covering of planished or Russian iron, the large headlights and the directness and visibility of the pipes and other appurtenances. Up to within as recent a time as the early seventies the so-called «American» type of locomotive, with its four coupled wheels and its four-wheeled truck, was the class of engine most generally adopted by railroad men in the United States. In fact, ever since the day of its first construction by Campbell, in 1836, it had been continuously used for almost every kind of general service — for the carrying of passengers as well as for freight and switching purposes, and it was not until the demand of the public upon the railways increased so greatly as to create the need of more powerful locomotives that special engines for freight service were constructed. It was to meet these requirements that the Mogul and ten-wheel types were adopted during the sixties, and that the Consolidation engines became the standard for the heaviest freight service between 1870 and 1880. During the seventies, the maximum load per axle was limited by the strength of the track to approximately 12 tons. This period, however, witnessed the general introduction of steel rails and steel tires; and the way was thus paved for a great increase in the weight and capacity of locomotives. Railway men became convinced of the superiority of the large locomotive, with its high tractive force and liberal heating surface; and the weight of the engines was increased to the limit permitted by the strength of tracks and bridges. If, in the beginning, the building of these excessively heavy engines was largely an experiment, it was not long before their practicability had become so well established that their size and weight continued to increase until cars were made that were capable of carrying loads of 50 tons or even more, in special cases; and locomotives were constructed with over 30 tons weight per axle. Such powerful locomotives were more costly and difficult of construction, but when the practicable economies in the matter of transportation which were made possible only by the use of cars of such great carrying capacity were taken into consideration, the balance was so strongly in favor of the big cars and the heavy, powerful locomotives, that railroad men found no reason to hesitate because of the question of first cost.

Since the beginning of the art of locomotive construction in the United States. American engine designers have been actuated by one desire: To produce a machine with sufficient flexibility of wheel-base to enable it to pass sharp curvature and adapt itself to the unevenness of track surfaces resulting from the action of severe frosts, as well as to facilitate the matter of repairs by striving to make every part so accessible that it might be removed without affecting the other parts of the engine.

Among the locomotive-builders whose experiments contributed to this result and who also played an important part in the work of increasing the capacity of the American engine were several establishments that either disappeared altogether or that discontinued the manufacture of this kind of machine to enter lines of business in which the competition was less intense. To speak of these firms recalls such names as the Norris Brothers of Philadelphia, whose work, in the early days of the industry, presented the most active competition to such builders as Baldwin and Rogers. After many business vicissitudes this firm ceased to exist in 1865; and in 1873 their plant was incorporated in the Baldwin Locomotive Works. In Baltimore, in the old days, there were two works, those of Ross Winans and the Denmeads. Boston had several plants, notably those of Seth Wilmarth, John Souther's Globe Works, the McKay and Aldus Works at East Boston and the Hinckley Locomotive and Machine Works, which was one of the representative houses in the industry up to 1888 or 1889. In fact, New England has always been a section of the country most actively interested in the work of locomotive building, the principal plants, in addition to those already named, being the works of Ballard Vail, at Andover, Mass.; Corliss and Nightingale, of Providence, R. I., a firm which, although George H. Corliss, the great engine builder, was at its head, proved less successful in the building of locomotives than in other branches of the trade; A. Latham and Company, of White River Junction, Vt.; the Locks and Canal Works, at Lowell, Mass.; the Amoskeag Locomotive Works, at Manchester, N. H.; the Lawrence Locomotive Works, at Lawrence, Mass.; the Taunton Locomotive Works, and the Mason Machine Works, at Taunton, Mass.; and the Portland, Me., Locomotive and Car Company.

Among other sections of the country New Jersey has been a special field for the manufacture of locomotives. The plant of William Swinburne, at Paterson, afterward known as the New Jersey Locomotive Works, and later as the Grant Locomotive Works, was one of the offshoots from the Rogers Works. For years it conducted business most successfully. Finally, in 1885, the Grant Locomotive Works found that it was impossible to meet the demands of modern requirements with its antiquated shop and inadequate facilities. Hence the works at Paterson were closed and the company removed to Chicago, where, after they had reorganized with new capital and thoroughly modern shops, they continued in operation until 1893. The financial depression of that year was too much for them, however, and the entire plant was sold to the Siemens and Halske Electric Company of Chicago. For a time it was operated both for the manufacture of electrical equipment and locomotives, but the business at last proved so unprofitable that the plant was closed. Among the other New Jersey manufacturers of locomotives were Breese, Kneeland and Company, who operated the Jersey City Locomotive Works, and Van Cleeve, McKean and Dripps, whose shops were located at Trenton.

For several years the firm of Eastwick and Harrison built locomotives at Newcastle, Del., and, when they failed in 1840, they were succeeded by the Newcastle Manufacturing Company, a concern that gained both wealth and international fame by their railway operations in Russia. In the West there were several manufacturers of note, some important works being located at Cleveland, Detroit, Milwaukee, Chicago and San Francisco. The Rome Locomotive Works, at Rome, N. Y., started under favorable auspices, but, after several years of more or less disastrous operations, went out of business in 1891.

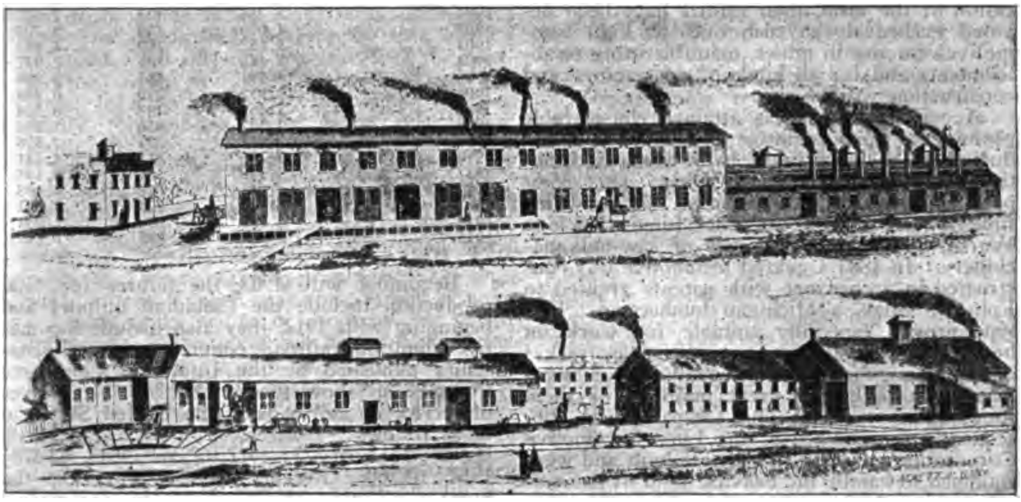
The Baldwin Locomotive Works, of Philadelphia, has the distinction of being not only one of the pioneers in the business of locomotive manufacture but is still one of the representative establishments in the industry. Established in 1831, by Matthias W. Baldwin, its product has steadily increased until it is now in excess of 200 locomotives a month. The works occupy an area of about 20 acres in the central part of the city, and when running at full capacity give employment to about 19,000 men. An extensive plant has also been erected on a tract of 225 acres of Eddystone, Pa., about 12 miles from Philadelphia; and a tract has been purchased at East Chicago, Ind.; where shops will be erected when business conditions warrant such expansion.

Another important plant was that of the Rogers Locomotive Works at Paterson, N. J. Founded in 1836, by the firm of Rogers, Ketchum and Grosvenor, the mechanical genius of the concern was Thomas Rogers. When he died, in 1856, the firm was incorporated under the title of the Rogers Locomotive and Machine Works, with Jacob S. Rogers as president, and business was transacted under this name until 1892, when the corporation was again reorganized and assumed the name of The Rogers Locomotive Works. The Rogers Company then had an annual capacity of more than 300 locomotives, and gave employment to about 2,000 persons.

Up to the time of the war with Spain the spirit of consolidation which had already shown its effect in other industries had been an unknown factor in the business of locomotive making. Soon after 1898, however, several of the competing works began to talk of the organization of a larger corporation, or combination, and the movement finally became so popular that, in July 1901, eight of the large manufactories were consolidated under the name of the American Locomotive Company, with a capital of $50,000,000, half of which is in common stock, and half in 7 per cent cumulative preferred. The works acquired by the organization were as follows:

	Locomotives per annum.
Schenectady Works, Schenectady, N. Y.	450
Brooks Works, Dunkirk, N. Y.	450
Pittsburgh Works, Pittsburgh, Pa.	200
Rhode Island Works, Providence, R. I.	150
Richmond Works, Richmond, Va.	150
Cooke Works, Paterson, N. J.	125
Manchester Works, Manchester, N. H.	100
Dickson Works, Scranton, Pa.	85
Approximate total capacity	1,710

In March 1904, the American Locomotive Company also acquired the stock of the Locomotive and Machine Company of Montreal, Limited, with works in Montreal, Canada, engaged in the building of locomotive and structural steel works. With the addition of the Rogers and the Montreal works the American Locomotive Company operated 10 plants with a total annual capacity of 3,100 locomotives.



Schenectady Works of the American Locomotive Company (1864).

Of the 10 plants the Schenectady Locomotive Works was established by the Norris Brothers in 1848. In 1863 it passed into the hands of John Ellis, who was eventually succeeded by his sons, John C., Charles G., Edward, William D. Ellis and Walter McQueen.

The Cooke Locomotive and Machine Company of Paterson, N. J., was established about 1800, but for nearly half a century they were employed almost exclusively in the manufacture of machinery. In 1852, however, they began to make locomotives, and as this branch of their business increased, the old shops were abandoned and new and up-to-date works were constructed.

The Pittsburgh Locomotive Works began operation late in 1865. Originally intended as a small shop, its capacity being at first limited to 30 locomotives per annum, they were so successful in placing orders for their product that the establishment now occupies an area of fully 12 acres. In their work of extending their capacity the best of fire-proof buildings have been erected, and the works are equipped with the latest and most improved electric, hydraulic and pneumatic appliances known to the art of locomotive construction.

The Rhode Island Locomotive Works, at Providence, R. I., commenced operations in 1865, and continued to occupy one of the most prominent positions in the rank of locomotive manufacturers up to the time of their absorption by the combination.

The Brooks Locomotive Works, at Dunkirk, N. Y., was originally intended to serve exclusively as the locomotive building and repair shops of the Erie Railroad. In 1869, however, the railway company decided to abandon these shops. Newer works had already been constructed in a more convenient location for the railway company's purposes and Jay Gould, who was then president of the road, saw no reason why the Dunkirk plant should not be closed. At that time, however, Horatio G. Brooks was the superintendent of motive power and machinery construction for the Erie road. As his home was at Dunkirk, and as all his interests centred about that place, he realized that the removal of these works would prove a severe blow to the prosperity of the town. As the result, he offered to lease the shop and its machinery for the purpose of undertaking the establishment of an independent concern, and as Mr. Gould was nothing loath to make such a mutually advantageous agreement, the lease was signed in November. Before the close of the year 1869, two locomotives had been turned out, and from that time the works were extended until, in 1883, the entire plant, which then covered an area of more than 20 acres, was purchased from the New York, Lake Erie and Western Railroad Company by the Brooks Locomotive Works.

The Richmond Locomotive and Machine Company, of Richmond, Va., was the only locomotive manufacturing plant in the South. When it was established, in 1865, it was intended for the manufacture of plantation and saw-mill machinery, and it was not until many years later that it began to build street cars — horse cars at first, and, finally, motor cars. In 1889 the company secured a contract from the government to build the machinery for the new battleship *Texas*, and, although this work was successfully completed, the concern has since devoted its attention almost exclusively to the making of locomotives.

The Dickson Manufacturing Company, of Scranton, Pa., was established in 1862, and, ever since that time, the concern has been successful manufacturers of locomotives and mining machinery, operating two separate establishments in Scranton for these purposes. The locomotive works were acquired by the American Locomotive Company in 1901.

The Manchester Locomotive Works, of Manchester, N. H., have been prominently identified with the locomotive building industry since they were established, in 1854, by Aretas Blood, one of the pioneers in engine construction.

The works of the H. K. Porter Company at Pittsburgh, Pa., were established by the firm of Smith and Porter, in 1866. Later the concern was known as Porter, Bell and Company. Although locomotive builders in the strict application of the term, their efforts have been devoted exclusively to such lines as light locomotives for use in mines, manufacturing establishments and for all kinds of contractors' and construction work.

A concern which has attained considerable prominence in locomotive building, especially during the past few years, is the Lima Locomotive Corporation of Lima, Ohio. This company built its first locomotive in 1879, at which time it was known as The Lima Machine Works, and made a specialty of saw-mill machinery. In 1880 a geared locomotive was constructed in accordance with patents granted to Ephraim Shay, a Michigan lumberman. This type proved especially suitable for work on heavy grades, sharp curves and uneven tracks: and large numbers of Shay geared locomotives have been built, the great majority of them for logging service. The company was subsequently reorganized as the Lima Locomotive Corporation and new shops were built and were equipped to handle the heaviest kind of locomotive work. With its present facilities, the company is successfully building all sizes of both geared and direct connected locomotives, from light engines for contractors' or industrial service, up to the heaviest classes of motive power for trunk line railways.

From the figures covering annual production which have already been given, it is not difficult to estimate that the aggregate capacity of the locomotive manufacturing establishments of the country, not including the railroad shops and the shops not regularly engaged in this business, is in excess of 5,000 locomotives. Of course, the demand for such machines varies from time to time, being dependent upon two factors: (1) The general prosperity of the country, a condition upon which the volume of freight to be transported, which is the basis of railroad earnings, so largely depends, and (2) the mileage of new lines under construction, the completion of which means new equipment. These two factors are really one, as new lines are scarcely ever built in those periods of financial stagnation when the people are hoarding their money and capitalists are too timid to venture to encroach upon their principal. As a result, business prosperity in the locomotive-manufacturing industry is intermittent. As the average life of a locomotive is about 20 years, it requires an annual production of some 2,500 machines to supply the demand due to natural conditions; and as the locomotive shops of the country possess a capacity of about twice that number of engines, the difference between these 2,500 and the total production of all the American works must find an outlet through one of these three channels: They must be used in the equipment of new lines; in the improvement and extension of old lines, or they must be exported to other countries. The following table shows the total production from 1898 to 1915 as well as the number exported to other lands than Canada or Mexico.

LOCOMOTIVES PRODUCED AND NUMBER EXPORTED

YEAR	Total production reported	Number exported omitting Mexico and Canada	Remainder not exported
1898	1,875	468	1,407
1899	2,473	517	1,956
1900	3,153	525	2,628
1901	3,284	423	2,861
1902	4,070	365	3,705
1903	5,152	289	4,863
1904	3,441	504	2,937
1905	5,491	583	4,908
1906	6,952	720	6,232
1907	7,362	798	6,564
1908	2,342	456	1,886
1909	2,887	291	2,596
1910	4,755	314	4,441
1911	3,530	387	3,143
1912	4,915	512	4,403
1913	5,332	771	4,561
1914	2,235	273	1,962
1915	2,085	835	1,250

Beginning with 1905, the figures for total production include the Canadian output; and beginning with 1912, they also include locomotives built in railroad company's shops. Statistics published by the Interstate Commerce Commission show the number of locomotives in service on railroads in the United States to be as follows: 1908, 56,733; 1909, 57,212; 1910, 58,947; 1911, 61,327; 1912, 62,262; 1913, 63,378; 1914, 64,760. Recent statistics covering the number of men employed in the locomotive building industry are difficult to obtain. In 1905, this number was approximately 40,000; and their wages amounted to fully $25,000,000 per annum. At the present time the total value of the products of the locomotive building establishments in the United States, when operating at full capacity, would annually be about $110,000,000.

Although American locomotive builders at first depended upon English models in their work, they were soon able to produce machines that attracted attention abroad. As far as is known, the first locomotives exported from this country were shipped to Cuba in 1838, by the Baldwin Locomotive Works. In 1840, locomotives were built for the Birmingham and Gloucester Railway, in England, by William Norris. In the following year, the

Baldwin Locomotive Works built a locomotive for Austria; and in 1845 they built three for the Royal Railway of Wurtemberg. Three years later the Rogers Locomotive Works shipped locomotives to Cuba, and the export business was well under way. Even England and Continental Europe, in spite of their facilities for locomotive construction, have at times purchased American built locomotives. Unfortunately there are no figures that can tell authoritatively how many locomotives were exported by the United States builders during the early years of the industry, and, as even the later statistics are incomplete, in view of the fact that they do not cover the shipments to Canada and Mexico, it is very difficult to obtain anything like a comprehensive idea of the subject. According to the best figures obtainable, during the 26 years that elapsed between 1879 and 1904, inclusive, no less than 6,173 were sent to foreign countries from ports in the United States, while their value was placed at $57,843,005. At the present time, American locomotives are in use in almost every inhabited portion of the globe.

One excuse for England's interest in American locomotives may be found in the labor conditions that have existed from time to time in that country. Thus, in 1898, when the Midland, the Great Northern and the Great Central railroads together ordered no less than 80 of our machines, 70 from the Baldwin works and 10 from the Schenectady works, they were somewhat compelled to resort to this method of relief. All through the year 1897 the engineering works of Great Britain had been affected by a strike, and, in 1898, when the men finally returned to their work, the several plants were so overcrowded with orders that it was impossible for them to meet all the demands that were made upon them. Naturally, when the American locomotives appeared they were subjected to all sorts of adverse criticism by the British builders. Efforts were made to show that they could not be compared to the English machines, either in point of speed, or in matter of economy, but as the statements made were all biased and inconclusive, the American manufacturers have not taken them greatly to heart, especially in view of the fact that they are constantly being called upon to furnish machines for use in various parts of Asia and Africa, where, coming into direct competition with the English product, the railroads have had an opportunity to test the truth of such charges.

The European War, which broke out in 1914, caused a considerable demand for American locomotives for service abroad. Engines for military purposes were ordered by the British, French and Russian governments and were built in remarkably short time. For example the Baldwin Locomotive Works built 20 light tank locomotives for the French government in 16 working days from the time the order was received.

In 1832, the Philadelphia, Germantown and Norristown Railroad Company paid Matthias W. Baldwin the sum of $3,500 for the locomotive "Old Ironsides." From that time the price charged for such machines slowly but steadily increased until, during the period of the Civil War, sums ranging from $30,000 to $35,000 were received for the heavy freight or passenger locomotives. Of course, locomotive building was no exception to the other industries, and, after war times, the prices of its product declined to about $7,000 for a 35-ton passenger locomotive. This was the price that prevailed about 1879. During 1880 and 1881, prices rose rapidly until fully $15,000 was paid for a similar machine; and they then declined gradually until 1896, when from $8,000 to $9,000 was paid for an average passenger locomotive and from $9,000 to $10,000 for an average freight locomotive. In general, as the total weight of locomotives has increased, there has been a decrease in the price per pound.

The introduction of the 50-ton steel car, in 1897, brought about a marked advance both in the weight and power of locomotives. To meet this new demand the weight of the ordinary consolidation freight locomotive, which had ranged from 60 to 70 tons, was increased to 80 to 100 tons, while some of the machines that were constructed were as heavy as 115 tons, exclusive of tender. As such an increase of weight and power had been inspired solely by business conditions, the railroads were quick to respond to such an evidence of prosperity by ordering the kind of rolling stock that was necessary to enable them to meet these new requirements and which would just as certainly increase their own earning power. In 1897 materials were expensive and wages were high. Taking these facts into consideration, it is by no means surprising that the construction of such heavy locomotives should have brought the price to $15,000 or $16,000.

During more recent years, the weight and power of locomotives has continued to advance. The Consolidation type has been superseded, to a considerable extent, by the Mikado, which provides increased steaming capacity in proportion to adhesion. Locomotives with five pairs of coupled driving-wheels have also been introduced, on a number of roads, for heavy freight service; while for the heaviest kind of work the Mallet articulated type, with driving-wheels arranged in two groups, is successfully employed. This type is the invention of Anatole Mallet, a French engineer, whose first articulated locomotives were built in Europe in 1889. The American Locomotive Company built the first Mallet for service in the United States in 1904. This engine was constructed for the Baltimore and Ohio Railroad and proved a decided success. The largest Mallet locomotives built for service in this country far exceed in weight and capacity any that are in use abroad.

The Baldwin Locomotive Works has developed the Mallet articulated design by placing driving-wheels under the tender, and thus utilizing the weight of the latter for tractive purposes. The first locomotive of this type was built in 1914, for the Erie Railroad. It runs on 28 wheels, 24 of which are used as driving-wheels; develops a tractive force of 160,000 pounds and weighs in working order 853,000 pounds. At the time of its construction, it was the heaviest steam locomotive ever built.

It was a similar demand for more powerful locomotives, for engines not only capable of hauling heavy trains at sustained high speed, but also of accelerating speed rapidly after starting, that brought the new and heavier types of passenger locomotive into existence. The old American, or eight-wheel type, was wholly incapable of meeting such requirements. The ten-wheel engine, which had been used quite successfully on heavy grades, proved unsatisfactory in such an emergency, owing to its comparatively small driving wheels, its inadequate firebox, an adhesion considerably in excess of the requirements, and excessive resistance within the machine itself. To overcome these difficulties the Baldwin Locomotive Works constructed the Atlantic type of engine. It was substantially a ten-wheel locomotive, in which the rear pair of driving wheels was replaced by a pair of trailing wheels of smaller diameter, permitting the introduction of a deep firebox with ample grate area and volume sufficient to admit of thorough combustion. Great boiler capacity was available in proportion to the adhesion; the driving wheels were closely coupled, and the total wheel base was sufficiently long to give smoothness of motion at high speed, and, at the same time, sufficient flexibility.

A development of the Atlantic type is found in the Pacific type, which has three pairs of driving-wheels with a four-wheeled leading and a two-wheeled trailing truck. Since the introduction of steel passenger cars, which frequently weight 75 tons or more apiece, Pacific type locomotives have come into extensive use, because of their great starting power and their ability to run at sustained high speed when hauling heavy trains.

The prices of these heavy locomotives are materially higher than those of the engines built in 1897; and large locomotives for road service now frequently cost $25,000 or more.

The fuel cost is the largest single item of expense in the operation of locomotives, and various devices have been tried, from time to time, with a view to promoting fuel economy. Compound locomotives, which were first introduced in Europe, were built with this end in view; and were at one time extensively used in the United States. These locomotives were successful as fuel savers; but, under the methods of operation prevailing on American railways, they proved difficult to maintain; and they are no longer being built, except in the case of the Mallet articulated compound locomotive, which is practically two single expansion engines placed under one boiler. The cylinders of the two engines are of different sizes, the larger, or low-pressure, receiving the exhaust from the smaller, or high-pressure; but the various features which proved undesirable in other types of compound locomotives are eliminated in the Mallet design.

The most effective fuel saving device at present in use on locomotives is the superheater. When saturated steam is used in the cylinders of a locomotive, a considerable portion of it — sometimes as much as 25 or 30 per cent — is condensed into water, and does no useful work. This loss can be avoided by heating the steam, before it enters the cylinders, to such an extent that its temperature will not be lowered to the point of condensation. In a locomotive using superheated steam, a number of the small boiler tubes are replaced by considerably larger tubes, and in these are placed groups of pipes through which the steam circulates before it enters the cylinders. The steam absorbs heat from the furnace gases passing through the large tubes, and its temperature is raised to such an extent that cylinder condensation is avoided. The increase in temperature depends upon the design of the superheater and the conditions under which the engine is working. It frequently amounts to 200° F. or more, and the fuel saving effected per horse power developed, as compared with a similar locomotive using saturated steam, averages about 25 per cent.

The economies resulting from the use of superheated steam have long been known, but it is only during comparatively recent years that superheaters fitted for use in locomotives have been devised. Much of the pioneer work along this line has been done by two German engineers, Wilhelm Schmidt and Robert Garbe. The great majority of heavy locomotives built in the United States since 1912 have been equipped with superheaters, the Schmidt system being used to the practical exclusion of all others. Many railroads have improved the efficiency of old locomotives, built to use saturated steam; and the results obtained have been highly satisfactory.

Fuel economy has also been promoted by improved furnace design, and the use of such devices as brick arches and combustion chambers. The largest coal-burning locomotives are now fired with mechanical stokers, and are developing powers which would be unattainable with hand firing.

As has been stated, Peter Cooper's first model attained a speed of 18 miles per hour. According to statements that ought to be regarded as reliable Baldwin's "Old Ironsides" once attained a record speed of 60 miles an hour for a short distance, and other examples of high speed had several times been shown by the old-time locomotives. In fact, the real progress in locomotive development in the United States had not been marked by an increased capacity for speed so much as by an increased hauling power. Instead of designing locomotives capable of breaking the speed record the American builders had been endeavoring to construct locomotives that would draw heavy trains at a steady rate of speed, and in this effort their success had been phenomenal. In the early nineties, however, there was a marked tendency to increase the speed of trains, especially on the principal Eastern lines. The following are some of the speed records made by American-built locomotives:

In November, 1892, locomotive No. 385 — a Vauclain compound — running on the Philadelphia and Reading and the Jersey Central railroads, between Philadelphia and Jersey City, with a train of four heavy cars attached, attained a speed equal to 97 miles per hour, by covering one mile in 37 seconds. On 19 July 1893, locomotive No. 682, on the Philadelphia and Reading Railroad, accomplished the remarkable feat of hauling a train of nine heavily loaded passenger cars from Winslow Junction to Pleasantville, a distance of 26 miles, in 22 minutes, which was equivalent to an average speed of 70.9 miles an hour. On 27 August the same locomotive succeeded in hauling 17 loaded passenger cars the same distance in 27 minutes, or at an average speed of 57 miles per hour, a performance which was even more remarkable, considering the weight of the train attached.

On 11 Sept. 1895, the Empire State Express, on the New York Central Railroad, with its four cars, ran from New York to East Buffalo, a distance of 436½ miles, in 407⅗ minutes, this being an average speed of 64.26 miles per hour. In 1897, and for several years thereafter, the Philadelphia and Reading Railroad operated during the summer months a service in which trains of five or six passenger cars were hauled between Camden and Atlantic City, a distance of 55½ miles, in 48 minutes, and these runs were made with great regularity. The locomotives used for this purpose were of the Atlantic type, with Wootten boilers and 84-inch driving wheels.

On 9 July 1905, what is known as the Scott Special, on the Atchison, Topeka and Santa Fé Railway, left Los Angeles for a continuous trip to Chicago. The distance of 2,245 miles was covered in 43 hours and 55 minutes, making an average of 52 miles per hour for the entire distance, the highest speed officially recorded for a given distance being at the rate of 106.1 miles per hour.

During the past few years, the subject of electric traction has received considerable attention from railway managers, and several installations are in successful operation. Among these may be mentioned the New York Central, the New York, New Haven and Hartford and the Pennsylvania electrifications, in and about New York City; the electrification of the Pennsylvania's suburban service between Philadelphia and Paoli; and the electrification of the Hoosac Tunnel, on the Boston and Maine; of the Cascade Tunnel on the Great Northern Railway, and of the Saint Clair Tunnel at Detroit, on the Michigan Central Railroad. The tunnel electrification of the Baltimore and Ohio Railroad at Baltimore should also be mentioned, as the first undertaking of this kind to be tried on an extensive scale. Two examples of heavy grade electrification — those of the Chicago, Milwaukee and Saint Paul Railway in the Rocky Mountains, and of the Norfolk and Western Railway in the Elkhorn district — are notable as cases where through traffic is being moved over trunk line railways for considerable distances, using electricity as a motive power.

In all the cases mentioned above, the operating results have proved satisfactory, and some remarkable records are made in regular service. On the Norfolk and Western, for example, the speed of freight trains up the heavy grades has been practically doubled, while two electric locomotives handle as much tonnage per train as three of the large Mallet steam locomotives formerly used.

The general electrification of steam railways is highly improbable for some time to come, not so much because of the difficulty in designing suitable equipment as because of the enormous cost involved. The electrification of a steam railway requires, not merely the replacing of steam locomotives by electric locomotives, but also the installation of power house and transmission equipment, of new shop and terminal facilities and various other items. Thus, while material savings in operation may, under favorable conditions, be effected by the use of electric locomotives, the first cost in the majority of cases is prohibitive. For some time to come, therefore, electrification will probably be confined to city terminals and large tunnels, to mountain grades and to congested districts where the amount of traffic moving is fairly constant during the greater part of the day.

No uniform method of developing, transmitting and utilizing electric power in railway work has as yet been adopted. Direct and alternating current, the overhead wire and the third rail, and various different types of locomotives, are all in successful use. Each electrification problem must be studied by itself, and that system used which is best fitted for the special conditions to be met.

The majority of electric locomotives are built on a co-operative plan, one company supplying the mechanical parts and another the electrical equipment. The Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Company have worked together in this way, as have also the American Locomotive Company and the General Electric Company. Thus the locomotives, in both their mechanical and electrical features, represent the work of designers and builders who are experts in their respective lines.

Before closing this review, mention should be made of the use of internal combustion motors in locomotive work. The extremely variable conditions as to speed and load, under which locomotives operate; the weight and space limitations which are necessarily imposed, and various other considerations, have hindered the introduction of this class of motor in general railway service. There is, however, a growing field for the internal combustion locomotive in light switching, contractors' and industrial service; and the success of these machines in such work points to their increasing use in the future.

The fact that the internal combustion locomotive consumes no fuel while standing idle makes it specially suitable for work in which the service requirements are intermittent. In plantation service, for example, when the mills are not grinding, it is desirable to have locomotives ready for immediate use, even though they may only occasionally be needed. Gasoline locomotives meet these conditions admirably, as they are dependent upon no external source of power, consume fuel only when operating and can be placed in service without previous preparation.

The Baldwin Locomotive Works has made a special study of the gasoline locomotive, and has developed a series of four standard designs weighing three and one-half, five, seven and nine tons, respectively. In many respects these machines follow steam locomotive practice. The entire construction, including the motor and transmission, is spring supported. The motor drives a transverse jack-shaft, from which power is transmitted to the wheels by means of side rods. No chains are used in the transmission system, and there is a positive drive from motor to wheels. The minor fittings and equipment are arranged, in each case, to suit the special conditions under which the locomotives operate. The locomotives can be built for any practicable track gauge, and can, if desired, be arranged to use alcohol for fuel instead of gasoline.

The immediate future will probably witness a continued increase in the weight and capacity of steam locomotives, and a greater refinement in their design for the purpose of developing maximum power in proportion to the fuel and water consumed. Electrification will be extended in districts where its advantages can be fully realized. The internal combustion motor possesses many advantages for railway work, and its extensive use in large locomotives may be expected as soon as a suitable design is produced. The difficulties here are by no means insurmountable, and there are prospects that a type of internal combustion motor will be developed which will, in turn, revolutionize the present methods of railway operation.

LOCOMOTIVES, Compound. See LOCOMOTIVE.

LOCOMOTIVES, Electric. See ELECTRIC RAILWAYS.

LOCOMOTOR ATAXIA, a popular name for a disease of the nervous system, which is caused exclusively by syphilis, although less than half of 1 per cent of those who have syphilis develop it, and usually occurs in adults from 40 to 50. It is characterized by pain, inability to walk and by progressive weakness which leads finally to death. The malady is long drawn out, becoming serious sometimes as many as 40 or 50 years after the first infection, and while not entailing, as a rule, a great amount of physical pain, causes extreme inconvenience to the patient. It is present in men more frequently than in women, because syphilis is more frequent in men. In the vast majority of patients it first shows itself by neuralgic pains of the lower extremities. Thus, there may be acute darting and lightning-like pains, lasting from half an hour to an hour or two, about the ankles, in the instep, shooting up the leg or in the thighs. Occasionally these pains are present in the arms and trunk. They are frequently diagnosed as neuralgia, and it is not until development of the symptoms of ataxia (q.v.), a word which means "inability to co-ordinate"— inability to walk in the dark and to place the foot or hand where the mind wishes it to be placed — that the true nature of the constant neuralgic pains is recognized. The patient finds himself insecure on uneven surfaces. He stumbles and falls, and must keep his eyes glued to his legs or the surface on which he is walking if he is to be able to control them. With the gradual development of the inability to walk there may be a number of other symptoms — acute, lightning-like pains in the stomach, intense, sometimes acute, pain in the bladder, sometimes loss of voice, etc. There may be patches of anæsthesia over the body and there is usually progressive muscular weakness. Loss of knee-jerks is an important early sign.

Associated with ataxia of the legs, which prevents the patient from walking readily in the dark, or up and down stairs, there may be some ataxia in the hands, whereby the finer movements of buttoning the clothing, of writing, etc., may be interfered with, although there may be no loss in muscular strength until the last stages of the disease. A very constant and usually a very early sign of locomotor ataxia consists in certain changes in the reactions of the pupil of the eye to light. This symptom is technically known as the Argyll-Robertson pupil, and shows a fixed pupil when exposed to the influence of light, but a pupil that dilates or contracts normally when tested for its powers of accommodation. Thus in a patient who has this symptom the pupils contract on looking at a near object and dilate on looking at a far object; but if a candle or beam of light is thrown suddenly on the eye, normal quick contraction of the pupil is diminished or absent. The Argyll-Robertson pupil is sometimes found as early as the neuralgias, and a diagnosis may often be made on that alone.

The progress of the disease is usually very slow; remissions occur, which give great hope to the patient and afford ample opportunities for all forms of charlatanism; but the final outcome is usually hopeless. Many conditions of the spinal cord are known in which some of the symptoms of locomotor ataxia are present, chronic neuritis from alcoholism being one. As many of these are recoverable, the diagnosis of locomotor ataxia is an extremely difficult one, and can be made only by the competent specialist. Consult Jelliffe, White, 'Diseases of the Nervous System' (1917). See SYPHILIS OF THE NERVOUS SYSTEM; TABES DORSALIS.

LOCRIS, the parts of ancient Greece inhabited and named after the Locrians, the oldest Grecian peoples. There were four branches — the Epicnemidian, the Opuntian, Ozolian and Epizephyrian Locrians, the last a colony from the Ozolian stock, living in Lower Italy. Their capital, Locri, was one of the most powerful, splendid and wealthy cities of Magna Græcia.

LOCUS, *in mathematics,* a converging location; when the conditions of a problem are not sufficient to determine the absolute position of a point, but restrict it to a certain line (or lines), this line is called the locus of the point. Thus, if the base and area of a triangle are given, the locus of the vertex is a straight line parallel to the base; or if the distance of a point from another point is in a given ratio to its distance from a given fixed line, the locus of the point is a conic section.

LOCUST. See GRASSHOPPERS; CICADA.

LOCUST, a genus (*Robinia*) of leguminous trees and shrubs. The species have odd-pinnate leaves; pea-like flowers in drooping racemes, and pods containing several bean-like seeds. They are all useful for ornamental planting, and one species, *R. pseudacacia,* is highly valued for its timber. This species, which is the best known, and is also called false acacia and black locust, is the largest of its genus, attaining heights exceeding 75 feet and girths greater than eight feet in the rich alluvial soils of Tennessee and Kentucky. Its hard, tough, close-grained yellow wood is especially useful for ship-building, fence-posts and other purposes in which great durability is required. It is also employed for making cog-wheels, tree-nails, for the interior finish of houses, for furniture and other uses where a highly polished wood is needed. It is the favorite material for policemen's clubs, not only because of its weight and toughness, when well seasoned, but because of its unusual resonance, giving a ringing report when struck upon the pavement as a signal which can be obtained from no other wood. In various parts of Europe great attention has been paid to the propagation of this tree, for ornament as well as for its useful properties, and its cultivation is further encouraged by the absence of the destroying insects mentioned below. It forms a pleasing object along the borders of many of the railways on the Continent, its spines adding to its usefulness as a hedge. When in bloom the large pendulous racemes of fragrant white flowers, contrasting with the light-green foliage, produce a fine effect and give this tree a rank among the most ornamental.

The chief objection to the tree is its liability to the attacks of insects, more than 40 species being known to feed upon its leaves and wood. The foliage destroyers, which include leaf-rollers, leaf-miners and several species that feed in exposed positions, are sometimes seriously destructive, the larvæ of one species, a saw-fly (*Nematis similaris*), sometimes destroying all the green parts. But they are less destructive than the borers, which tunnel through and weaken the wood. Sometimes these are so numerous that the trees become mere shells of bark with a honeycomb of wood. The more important of them are the locust borer (*Cyllene robiniæ*), a black and yellow striped, long-horned beetle in the adult stage, which is common in the eastern United States; and the larvæ of a moth (*Sciapteron robiniæ*), troublesome in the Pacific Coast region. These and some others have discouraged the commercial planting of this valuable tree.

Other American «locust» trees are the two species of the genus *Gleditsia* of the senna family. These are the water or swamp locust (*G. aquatica*) of Florida, which has enormous spines and reddish flat oval pods; and the well-known and widely-planted honey locust or honey shucks (*G. triacanthos*). This large, graceful but exceedingly thorny tree bears especially fragrant flowers, and its pods are gathered by country people in the South and eaten for the sake of the sweet pulp between the seeds. The great pods measure 10 to 20 inches long, are curved, and «in drying twist and retwist while they open, and skilfully scatter seeds in diverse directions.»

LOCUST BIRD. See Pastor.

LOCY, William Albert, American zoölogist: b. Troy, Mich., 14 Sept. 1857. In 1881 he was graduated at the University of Michigan, and subsequently studied at Harvard, Berlin and Chicago. In 1887–89 he was professor of biology, in 1889–96 of animal morphology at Lake Forest University, Illinois. Since 1896 he has been professor of zoology at Northwest University. In 1902–03 he was employed as investigator at the Naples Zoological Station. He has written numerous scientific papers and monographs in technological journals; was editor in charge of zoological articles, and author of several in cyclopedias and author of 'Biology and Its Makers' (1908), and 'The Main Currents of Zoology' (1918).

LODDON, Australia, one of the most important rivers of Victoria, rising on the northern slopes of the Dividing Range, in Talbot County, flowing northwest for 250 miles and joining the Murray at Swan Hill. It drains a basin of 4,800 miles and is subject to floods. Good cod and bream abound in it.

LODE, a metalliferous deposit, usually having the character of an ore-producing vein; or often a parallel system of closely spaced veins. See Veins.

LODESTAR, LOADSTAR, POLARIS, or GUIDING STAR, various names given to the polar star which is the last star in the tail of the Little Bear. It is a star of the second magnitude, located 1° 20′ from the North Pole.

LODÈVE, lō'dĕv', France, town and capital of an arrondissement in the department of Hérault, on the Lergue, 36 miles west-northwest of Montpellier. It has many interesting remains, including its ancient walls, a fortified cathedral dating from the 10th century, an ancient monastery and a communal college. The principal industry is the manufacture of army woolens. Cloth, wine, brandy and wool are exported. Lodève, the ancient Luteva, existed before the Roman period. By the Romans it was known for a time as Forum Neronis. In the 4th century (323) it became a Christian city under Saint Flour, its first bishop, and remained an episcopal see down to the Revolution of 1789. The town fell successively to the Visigoths, Franks, Ostrogoths, the Arabs and Carolingians, became a countship in the 9th century and afterward became the domain of its bishops. It was sacked in 1573 during the religious wars. Pop. 6,300.

LODGE, Gonzalez, American classical scholar: b. Fort Littleton, Pa., 19 Dec. 1863. He was graduated from Johns Hopkins University in 1883, and in 1886 was professor of Greek in Davidson College, N. C., 1886–88, and of Latin at Bryn Mawr College, 1889–1900. Since 1900 he has been professor of Greek and Latin at Teachers College, Columbia University. He has published 'Lexicon Plautinum' (1901–14), and with Gildersleeve, 'Gildersleeve-Lodge Latin Grammar and Latin Composition.' He has edited 'The Gorgias of Plato' (1890), and supervised the 'Gildersleeve-Lodge Latin Series' (16 vols.). His studies in the essential vocabulary of Latin, 'The Vocabulary of High School Latin' (1907) have formed the basis of all recent high-school textbooks. He was joint-founder and editor of the *Classical Weekly* from 1907–1913.

LODGE, Henry Cabot, American statesman and historian: b. Boston, 12 May 1850. He was graduated at Harvard in 1871 and from the Law School there in 1874. From 1873 to 1876 he edited the *North American Review*. In the three years following he lectured on American history at Harvard and in 1879–81 edited the *International Review*. He was a member of the Massachusetts House of Representatives in 1880–81, member of Congress 1886–93 and thereafter United States senator from Massachusetts, being re-elected in 1899, 1905, 1911 and 1917. He was permanent chairman of the Republican National Convention of 1900 at Philadelphia, chairman of the committee on resolutions of the Chicago Republican Convention of 1904 and permanent chairman of the Republican National Convention of 1908 at Chicago. He was a member of the Alaska Boundary Commission; was regent of the Smithsonian Institution, 1886–93, and again appointed regent in 1905. In politics he is a Republican of conservative tendency; was a staunch supporter of the McKinley administration during the war with Spain. He has favored laws to safeguard the franchise and has advocated an educational test law for immigrants. He is a member of the American Institute of Arts and Letters and many other societies and has received academic honors from several of the leading American universities. His published works include ‘The Land Law of the Anglo-Saxons’ (1877); ‘Life and Letters of George Cabot’ (1881); ‘Short History of the English Colonies in America’ (1882); ‘Life of Alexander Hamilton’ (1883); ‘Life of Daniel Webster’ (1885); editor ‘Works of Alexander Hamilton’ (9 vols., 1886); ‘Studies in History’ (1889); ‘Life of Washington’ (2 vols., 1891); ‘History of Boston’ (1892); ‘Historical and Political Essays’ (1895); ‘Hero Tales from American History,’ with Theodore Roosevelt (1897); ‘Certain Accepted Heroes’ (1898); ‘Story of the Revolution’ (2 vols., 1899); ‘Story of the Spanish War, ‘A Fighting Frigate’ (1906); ‘A Frontier Town and Other Essays’ (1910); ‘Speeches and Addresses 1884–1909’ (1913); ‘Early Memories’ (1915); ‘One Hundred Years of Peace’ (1915); ‘The Democracy of the Constitution and Other Essays’ (1915).

LODGE, Sir Oliver Joseph, English physicist: b. Penkhull, Staffordshire, 12 June 1851. He was educated at University College, London, became demonstrator in physics there in 1875, and professor of the same subject in 1877. He was professor of physics at University College, Liverpool, 1881–1900, and in the latter year was appointed principal of the University of Birmingham. He was Rumford Medallist of the Royal Society in 1898; Romanes lecturer at Oxford 1903; president of the Physical Society of London 1899–1900; president of the Society for Psychical Research 1901–04; and president of the British Association, 1913–14. He was knighted in 1902. He achieved eminence as a physicist in his work in connection with electricity, including the theories of contact electricity and electrolysis, the oscillatory discharge of Leyden jars, the production of electro-magnetic waves in air, experiments in the mitigation of fogs through electrical dispersion, and in the invention of the «coherer» in wireless telegraphy. His work as an educational reformer has been overshadowed in the public mind by his attitude on the vexed question of religion and science, and by his views on psychical research and spiritualism. He has expounded the view that communication between the living and the dead may be attained unhampered. In this connection his latest book, ‘Raymond; or Life and Death’ (1916) has a pathetic interest. His son Raymond was killed in September 1915 in the Great War, and the book records communications begun soon after his death, made in the ordinary spiritualist way at séances held in presence of Sir Oliver and his family. His works include ‘Elementary Mechanics’ (1877); ‘Modern Views of Electricity’ (1889); ‘Lightning Conductors and Lightning Guards’ (1892); ‘Pioneers of Science’ (1893); ‘Modern Views on Matter’ (1903); ‘Life and Matter’ (4th ed., 1907); ‘The Substance of Faith’ (1907); ‘Man and the Universe’ (5th ed., 1909); ‘The Immortality of the Soul’ (1908); ‘The Ether of Space’ (1909); ‘Parent and Child’ (1910); ‘Modern Problems’ (1912); ‘Continuity’ (1914); ‘Raymond, or Life and Death’ (1915); ‘Christopher’ (1919).

LODGE, Thomas, English dramatist and poet: b. West Ham, near London, England, about 1556; d. London, September 1625. He entered at Lincoln's Inn, but seems to have led a wild and rollicking life, and in 1589–91 varied his life by taking part in two sea expeditions against the Spaniards, in the neighborhood of the Azores and Canary Islands. On the earlier of these he wrote the famous pastoral ‘Rosalynde Euphyes's Golden Legacie’ (1590), which supplied Shakespeare with the basis of ‘As You Like It.’ Lodge himself wrote two dramas, ‘The Wounds of Civil War’ (1594; reprinted in Hazlitt's Dodsley's ‘Select Collection of Old Plays,’ Vol. VII), and ‘A Looking-glass for London and England’ (1594), in collaboration with Robert Greene. Consult Jusserand, ‘The English Novel in the Time of Shakespeare’ (1890).

LODGING-HOUSES. Shelters for homeless people. The modern trend of workers to the cities has greatly increased the floating population and many people of this class are without means of purchasing adequate accommodations. Many systems for caring for this homeless population have been tried with more or less success and in all large cities there are now rescue missions and lodging-houses where a bed or room for the night may be had for a few cents. In New York conspicuous among such institutions are the Mills hotels with private rooms, free baths, etc., for a charge of 20 to 40 cents. The larger cities of America, such as Boston, Chicago, New York, have in recent years established municipal lodging-houses where lodging and breakfast are given in return for a few hours' labor, or free of all labor or compensation of any kind. There are stringent regulations, however, regarding the number of times a homeless person may avail himself of such accommodations. The Salvation Army and other charitable organizations also minister to the homeless. In Europe the matter is similarly handled. Consult Riis, Jacob, ‘The Children of the Poor’ (New York 1902); Dawson, W. H., ‘The German Workman’ (London 1906); Robins, Raymond, ‘What Constitutes a Municipal Lodging House’ (New York 1904).

LODGINGS, furnished rooms or apartments let by the owner or sublet by a tenant in possession for occupancy for limited periods, usually by the week or month. An agreement to let furnished lodgings is an agreement to land under the Statute of Frauds, and, in the absence of part performance, cannot be enforced, unless in writing signed by the defendant. In the letting of furnished apartments there is an implied warranty that the rooms are fit for occupation. Any person who lets lodgings without disinfecting them after infectious disease, or gives a false answer to any question as to the existence of any infectious disease, is liable to fine or imprisonment. A lodging-house-keeper is not liable for the loss or destruction of the lodger's goods without the former's fault. The relation is not that of landlord and tenant, the lodger acquiring by his contract no right of property in the premises but only a license to use the same, subject to the terms of agreement. The above provisions are the features of the New York code which in general is followed in other State jurisdictions. See Landlord and Tenant.

LODI, lō'dē, Cal., city in San Joaquin County, situated on the Mokelumne, and on the Southern Pacific and Central California railroads, 35 miles south of Sacramento. It contains a city administration building, Carnegie library and a high school. It has extensive fruit-growing interests and has great packing sheds, fruit juice factories, etc. The city owns the water-supply system and the electric-lighting system. Pop. 2,690.

LODI, Italy, a town in the province of Milan, Lombardy, on the Adda, 18 miles southeast of Milan. The principal buildings are the duomo or cathedral, a Gothic structure of the 12th century; the octagonal church of the Incoronata, built in the 15th century; the townhouse; the episcopal palace; the Barni and Merlini palaces. Majolica and delftware, refined wax, saltpeter and chemical products are manufactured. Stracchino and Parmesan cheese, which, though it takes its name from Parma, from which it was first exported, is almost wholly made in the district around Lodi, utilizing the milk of thousands of cows. The chief incident in Lodi's history is the entry by Napoleon after the famous passage of the bridge of Lodi effected against the Austrians, 10 May 1796. Four miles to the west are the famous ruins of an old Roman colony. Pop. of commune, 28,032.

LODI, N. J., borough in Bergen County, adjoining Passaic on the northeast, on the New York, Susquehanna and Western Railroad. It contains several silk and cotton mills, bleaching works, rubber works, etc. The borough owns the water-supply system. Pop. 4,130.

LODOMERIA, lō-dō-mē'rĭ-ạ, Austria-Hungary, a former independent principality in Volhynia, since the division of Poland in 1772 constituting an integral part of Galicia (q.v.).

LODZ, lōdz, Poland, the capital of a district in the government of Piotrkow, 76 miles southwest of Warsaw, and an important manufacturing centre, the terminus of a branch line from the Warsaw and Vienna Railway. It has made considerable modern progress, owing to the flourishing condition of its cotton, woolen and other manufactures. Silk goods are also manufactured, and there are dyeworks, breweries, machine-works, etc. The Roman Catholic Poles number about 40 per cent, German Protestants 33 per cent and Jews 27 per cent of the population, which from 50,000 in 1872 had increased in 1912 to 450,000. Captured by the Germans in the early days of the Great War which began in 1914, it was recaptured by the Russians in 1916, and again fell into the hands of the Central Powers in 1917.

LOEB, lĕb, **Jacques,** German-American physiologist and biologist: b. Germany, 7 April 1859. He studied at Berlin, Munich and Strassburg, was assistant at both Würzburg (1886–88) and Strassburg (1888–90), studied at the Naples zoological station, and in 1891–92 was associate professor of biology at Bryn Mawr College. In 1892 he became assistant professor of physiology and experimental biology at the University of Chicago, and in 1895 associate professor. He was also professor of physiology at the Rush Medical College of Chicago from 1900. In 1902 he was appointed professor of physiology in the University of California. Since 1910 he has been a member of the Rockefeller Institute for Medical Research in New York. His experiments have been in different fields of physiology and biology, all trying to show that complicated life phenomena can be reduced to simple physico-chemical laws. In his earlier work he showed that complicated animal instincts are identical with those reactions of plants which are known as tropisms, and he and his collaborators have recently shown that the law of Bunsen and Roscoe which controls the chemical effects of light also expresses the influence of light upon those animal instincts which fall under the name of heliotropism. His experiments on artificial parthenogenesis have furnished the proof that the fertilizing effect of the living spermatozoon can be replaced by simple solutions. Other experiments deal with the influence of salts upon life phenomena, with regeneration and heteromorphosis, with effects of temperature, etc. He has published numerous papers in scientific journals and the following books: 'Der Heliotropismus der Tiere und seine Übereinstimmung mit dem Heliotropismus der Pflanzen' (1890); 'Untersuchungen zur physiologischen Morphologie der Tiere' (1891–92); 'Comparative Physiology of the Brain and Comparative Psychology' (1900); 'Studies in General Physiology' (1906); 'Untersuchungen über künstliche Parthenogenese' (1906); 'The Dynamics of Living Matter' (1906); 'The Mechanistic Conception of Life' (1912); 'Artificial Parthenogenesis and Fertilization' (1913).

LOEB, James, American banker and Hellenist: b. New York, N. Y., 6 Aug. 1867. He was graduated at Harvard University in 1888 and from that year until 1901 was a member of the banking firm of Kuhn, Loeb and Company, New York. He is a member of the English Society for the Promotion of Hellenic Studies; in 1911 he turned over his collection of Aretine pottery to the Fogg Museum at Harvard, and in the same year perfected plans for the publication of a library of Greek and Latin authors — text and translation. The volumes, known as the Loeb Classical Library, began to appear in 1912 and were continued in the following years. Mr. Loeb has published translations of Paul Delcharme's 'Euripides and the Spirit of His Dreams,' and of Maurice Croiset's 'Aristophanes and the Political Parties at Athens.'

LOEB, Leo, American pathologist: b. Germany, 21 Sept. 1869. He received his education at the universities of Heidelberg, Berlin, Zürich and Freiburg (1889–96) and in 1903 was research Fellow at McGill University, Montreal. In 1900–01 he was adjunct professor of pathology at the University of Illinois; in 1902 experimental pathologist of the New York State Pathological Laboratory at Buffalo; in 1904–10 assistant professor of experimental pathology at the University of Pennsylvania; in 1910–15 director of the department of pathology of the Barnard Skin and Cancer Hospital, Saint Louis, and since 1915 professor of comparative pathology at Washington University. Professor Loeb is fellow or member of many scientific societies and is a contributor, chiefly on tissue and tumor growth, physiology of generative organs, pathology of circulation, venom of Heloderma, etc., to professional journals.

LOEB, Louis, American artist: b. Cleveland, Ohio, 1866; d. 1909. He completed his studies in art under Gérôme in Paris, winning honorable mention at the Salon in 1895, and a third medal in 1897. As artist, illustrator and teacher he secured a notable place. As an illustrator of books and magazines he showed both strength and inventive ability. In 1903 his exhibition of oils at the new rooms of the Co-operative Society in New York aroused interest in his later work, which shows a steady progress in his artistic achievements. His best-known works are ‹Temple of the Winds› (1898), in the Metropolitan Museum, New York; ‹The Breeze› (1900); ‹The Dawn› (1903); ‹The Siren› (1905); portrait of Eleanor Robson (1905); ‹Miranda› (1906), in the Metropolitan Museum, New York; ‹The Summit› (1907); ‹Princess Zomona› (1908). He was awarded two silver medals at the Saint Louis Exposition 1904.

LOEB CLASSICAL LIBRARY. See LOEB, JAMES.

LOEFFLER, lĕf'lėr, **Charles Martin Tornov,** American musician and composer: b. Mühlhausen, Alsace, 30 Jan. 1861. He was educated in Switzerland, Germany and France, came to America in 1881 and for over 20 years was violinist with the Boston Symphony Orchestra. Since 1909 he has been director of the Boston Opera Company. His compositions are remarkable for their technique although lacking in originality. They include ‹Les veillées de l'Ukraine,› suite for orchestra and violin (1891); ‹Fantastic Concerto› (1894); ‹Divertimento in A minor,› for violin and orchestra (1895); the symphonic poem, ‹The Death of Fintagiles,› for orchestra and viola d'amore (1897); ‹Divertissement Espagnol,› for orchestra and saxophone (1901); ‹La bonne chanson,› a symphonic poem; ‹La Villanelle du diable,› symphonic poem; quartet in A minor, chamber music; ‹Deux Rapsodies,› for oboe, viola and piano (1901); ‹By the Waters of Babylon,› Psalm 137, for female chorus (1902); ‹For One Who Fell in Battle,› chorus for eight parts (1906); ‹Pagan Poem,› for orchestra and piano, also many songs, transcriptions, etc.

LOEFFLER, Friedrich, German bacteriologist: b. Frankfort-on-the-Oder, 1852; d. 1915. He was educated at Würzburg and Berlin, in 1879 was made assistant in the Imperial Health Office and in 1884 staff physician at the Friedrich Wilhelm Institute, Berlin. Four years later he was appointed to a chair at the University of Greifswald. Loeffler rendered important and lasting services to bacteriology by his original methods of staining, by the discovery of the bacillus of glanders in 1882, and by the discovery of the bacillus of diphtheria. He also investigated the foot-and-mouth disease. In 1887 Professor Loeffler founded the *Zentralblatt für Bakteriologie und Parasitik.* To it he contributed several articles on professional topics, also articles on malaria in Leyden and Klemperer ‹Deutsche Klinik› (1903). He published ‹Vorlesungen über die geschichtliche Entwicklung der Lehre von den Bakterien› (1887) and ‹Die Schutzimpfung gegen die Maul und Klauensenche› (1903).

LOESS, lĕs or lō'ĕs, a loamy deposit of Pleistocene Age, abundantly developed in the valleys of the Rhine, the Danube, the Rhone and many of their tributaries. It is a pulverulent yellowish-gray or brownish loam, homogeneous and non-plastic, and consists principally of clay with small angular grains of quartz, and extremely minute scales of mica, together with a larger or smaller admixture of carbonate of lime and some iron oxide. It has a tendency to cleave in vertical planes, and thus forms cliffs where streams intersect it. The organic remains of the loess consist principally of land-shells of existing species, but now and again fresh-water shells are met with. Occasionally, also, the remains of man and the Pleistocene mammals are encountered. The deposit varies from a small thickness up to nearly 300 feet, and occurs at greatly differing levels, so that more than one agency would seem to have been active in its formation. Escaping flood-waters from glaciers are believed to have made some of the deposit; some of it may have been the result of weathering and rain-washings. The European loess is undoubtedly associated with the glacial deposits of the Continent, and in North America the same relationship obtains. Many geologists of the United States Geological Survey maintain that the accumulations which cover enormous areas in the great basin traversed by the Mississippi and its affluents are essentially fluviatile. Richthofen believes the Chinese accumulation, the largest in the world, to have been of Æolian origin, and this theory of wind-blown material has also been advanced with respect to deposits in the United States. There is no unanimity of opinion as to its origin, but loess is probably in part fluviatile and in part wind-blown. Consult Sixth Annual Report of the United States Geological Survey (1888); Chamberlin and Salisbury, ‹The Driftless Area of the Upper Mississippi Valley›; McGee, ‹The Pleistocene History of Northeastern Iowa,› in the United States Geological Survey, Eleventh Annual Report (1891); Geikie, ‹Prehistoric Europe› (1881).

LOEWE, lė'vĕ, **Wilhelm** (also called LOEWE-KALBE), German politician: b. Olvenstedt, near Magdeburg 1814; d. 1886. He was educated at Halle, and adopted the medical profession. Elected in 1848 to the Frankfort Parliament, he acted with the extreme party of democracy; became first vice-president of the Parliament; and later, at Stuttgart, was its president. Charged with sedition in this, which was considered a revolutionary procedure, and once acquitted, he was nevertheless sentenced to life imprisonment for contumacy. After some years in Switzerland, France and England, he came to this country, and for eight years practised medicine in New York. Availing himself of the amnesty in 1861, he returned to Germany, and in 1863 was elected to the Prussian House of Deputies. Four years later he was a Progressist member of the North German Reichstag. Disagreeing with his party in 1874 on the military law, he attempted to form a new Liberal party. He favored the policy of high protection adopted in 1879. In the elections of 1881 he lost his seat.

LOEWY, lė-vē′, **Maurice,** French astronomer: b. Vienna, 1833; d. Paris, 16 Oct. 1907. He was given a position in the observatory at Paris by Leverrier, and after the latter's death assisted Mouchez in the observatory of Montsouris, becoming director in 1896. He was noted for his invention of the *equatorial-coudé*, or Elbow-equatorial, in which the observer remains seated at the upper end of the polar axis of the telescope, as if working with a microscope on a table, with the means of directing his view to any part of the heavens under his control. He also devised improved methods of determining the constants of astronomical refraction and aberration. He was joint author (with Puiseux) of ‘Atlas photographie de la lune’ in six volumes (1896–1908).

LOFFTZ, lĕftz, **Ludwig,** German painter: b. Darmstadt, 1845; d. 1910. He studied at Nuremberg under Kreling and Raupp and at Munich under Diez. In 1879 he became professor at the Academy of Munich, and from 1891 to 1899 was director of this institution. His best-known paintings are ‘Cardinal Playing the Organ’ (1876; exhibited in New York 1909); portrait of Liszt; ‘Avarice and Love’ (1879, owned by W. H. Vanderbilt, New York); ‘Erasmus,’ in the Stuttgart Museum; ‘Pietà,’ and ‘Eurydice’ (1898), both in the New Pinakothek, Munich, ‘Assumption of the Virgin’ (1889), in Freising Cathedral. In his later years he painted several landscapes, but his greatest success lay in his work as a teacher.

LOFOTEN, lō-fō′ten, or **LOFODDEN,** Norway, a group of islands off the northwest coast, stretching southwest to northeast about 175 miles and including the Vesteraaelen islands to the north. The largest are Andoen, Langoen, Hindoen (the largest 860 square miles), East and West Vaagen and Flagstadöe. They have bold, precipitous, rugged and deeply indented coasts, the channels between which are deep, narrow and tortuous, and an elevated, sterile interior, several containing mountains which, though not lofty, are covered with perpetual snow. The highest peak is Higrafstind (3,811 feet). Immense shoals of cod and herring frequent their shores, and extensive and valuable fisheries are carried on. The principal cod-fishery beginning January-February ends in April, but the herring-fishery continues, and furnishes an important branch of national revenue. In ordinary years about 4,000 boats, each manned by five hands, are employed. The celebrated whirlpool, the Maelstrom, is situated at the southwest extremity of these islands. Permanent population of group, about 40,000.

LOFTIE, William John, Irish-Anglican clergyman, writer on antiquities: b. Tandragee, County Armagh, 25 July 1839; d. 16 June 1911. He was educated at Trinity College, Dublin, and after holding church appointments joined the staff of the *Saturday Review*, and in 1894 that of the *National Observer*. As a writer on antiquarian subjects he combined learning and picturesque statement. He published ‘Round About London’ (1877; 4th ed., 1880); ‘Plea for Art in the House’ (1877); ‘Memorials of the Savoy’ (1879); ‘A Ride in Egypt’ (1879); ‘A History of London’ (1883); ‘Authorized Guide to the Tower of London’ (1886); ‘London’ (1887); ‘Windsor’ (1887); ‘Westminster Abbey’ (1890); ‘The Cathedral Churches of England’ (1892); ‘Inigo Jones and Wren’ (1893); ‘Inns of Court and Chancery’ (1894); ‘London Afternoons’ (1901); ‘Coronation Book of Edward VII’; ‘Colour of London’ (1907).

LOFTUS, Lord **Augustus William Frederick Spencer,** English diplomatist: b. 4 Oct. 1817; d. 9 March 1904. He entered the diplomatic service in 1837 as attaché at Berlin and was likewise attaché at Stuttgart in 1844. He was secretary to Stratford Canning in 1848, and after serving as secretary of legation at Stuttgart (1852), and Berlin (1853), was envoy at Vienna (1858), Berlin (1860) and Munich (1862); became Ambassador at Berlin 1865, to the North German Confederation (1868–71) and to Saint Petersburg (1871–79). He was governor of New South Wales (1879–85). He published his Reminiscences (1892–94).

LOG, in nautical parlance, an apparatus used to measure the rate of a ship's velocity through the water. For this purpose there are several inventions, but the one most generally used is the following, called the common log. It is a piece of thin board, forming the quadrant of a circle of about six inches radius, and balanced by a small plate of lead, nailed on the circular part, so as to float vertically in the water, with the greater part immersed. The log-line is fastened to the log by means of three leads, two being knotted, through holes at one corner and the top while the other is attached to a pin fixed in a hole at the other corner, so as to draw out when a considerable force is exerted on it. The log-line is divided by means of knots of colored cloth into equal lengths, which are in the same proportion to an equal number of geographical or nautical miles, as a half or quarter minute is to an hour of time. It is wound upon a reel. The whole is employed to measure the ship's head-way in the following manner:— The reel being held by one man, and the half-minute glass by another, the mate of the watch fixes the pin and throws the log over the stern, which floating vertically offers immediate resistance through its area set at right angles to the direction of the ship, and is considered as stationary, the line being allowed to run freely over the stern to prevent the pin being pulled out. The knots are measured from a mark on the line at the distance of 12 or 15 fathoms from the log. The part of the line between the log and this mark is called the stray-line. The glass is turned at the instant that the mark passes over the stern, and as soon as the sand in the glass is run out the line is stopped. The resistance of the water then acting on the log dislodges the pin, so that the board, now presenting only its edge to the water, is easily drawn aboard. The number of knots which had run off at the expiration of the glass determines the ship's velocity. Two types of sand-glasses are in common use among mariners, one emptying in 30 seconds, and the other in 28 seconds. In the first instance, in laying out the knots in a log line the proportion would read:

1 hour (3,690 sec.): 30: : 1 mile (6,080 feet): 1 knot.

making the length of the “knot” — that is, the length between two knots on the line — 50 feet

7 inches. Where the 28-second sand glass is used the «knot» is 47 feet 3 inches in length. Where the speed of the vessel is greater than six knots that is, six nautical miles per hour — the line would run out an inconvenient distance in 28 or 30 seconds, so in faster ships a 14-second or 15-second glass is used, and the number of knots passing in that period multiplied by two to give the speed per hour.

The patent log or taffrail log is an altogether different instrument for the same purpose. Instead of a long line running out freely, the patent log has a fixed length of line, about three fathoms for each knot of the ship's average speed, and is dragged after the ship. The drag is an arrangement similar to a screw, having a central shank, and fins running lengthwise around it in helical form. When it is dragged through the water the fins cause it to rotate, and the faster it is dragged the faster it rotates. The entire log line turns with it and the number of turns is recorded by mechanism fastened to the taffrail of the vessel, and is shown on a dial.

LOG-BOOK, a book in which are officially recorded the proceedings on board a ship, supplied in England by the Board of Trade. In it the contents of the log-board are daily transscribed at noon, together with every circumstance deserving notice that may happen to the ship or within her cognizance, either at sea or in a harbor, etc. In addition to the weather, speed, astronomical observations, etc., the entries required to be made include convictions, offenses, punishments, conduct of crew, illnesses and injuries, deaths, births and marriages, quitting the ship, wages of men entering the navy, wages of deceased seamen, sale of deceased seamen's effects, collisions — in short, every condition, occurrence and transaction which comes under official notice. The log-book must be signed by master and mate, and certain other persons in particular cases. Properly authenticated entries are admissible in a court of law. A log is also kept by the master for the benefit of the owners. On steamships the chief engineer is also responsible for the keeping of a log in which are recorded all details connected with his department while the ship is at sea.

LOG CABIN AND HARD CIDER, a term used in American politics in the campaign of 1840. The Whig candidate for President, William Henry Harrison, was a military man of plain manners. One of the Democratic papers, scoffing at the Whigs for taking a candidate not of the first calibre, advised that Harrison be given a log cabin and a barrel of hard cider, and he would stay contentedly in Ohio. This was taken up by the Whigs, and really helped to make their candidate popular with the masses. Log cabins were erected in great numbers in the cities, and were carried in processions, accompanied with barrels of hard cider.

LOG-CABIN HARRISON. See LOG CABIN AND HARD CIDER.

LOG PERCH, a fish of the darter group, and its largest member. It is locally known as hogfish, hog molly, rockfish, etc., and is easily distinguished by its zebra stripes. It attains a length of eight inches and frequents clear cold streams. Consult Jordan and Copeland, 'Johnny Darters' (in *American Naturalist*, Vol. X, Salem 1876).

LOG-ROLLING, in American politics, a term used for manœuvers of politicians, by which they seek to secure co-operation in carrying favorite measures through legislatures and other bodies. Generally log-rolling is employed by individuals who approach others in support of personal schemes and interests. The word was formerly very popular in the United States, but has become almost obsolete, being supplanted by the term «button-holing.»

LOGAN, lō'gan, English name of the American Indian chief Tah-gah-jute: b. about 1725; d. 1780. He was the son of Shikellamy, a celebrated chief of the Cayugas, who lived at Shamokin on the Susquehanna, and was called Logan from James Logan, the secretary of Pennsylvania and a firm friend of the Indians. In his early manhood he was known throughout the frontier of Virginia and Pennsylvania for his fine personal appearance, engaging qualities and his friendship for the whites. About 1770 he removed with his family to the banks of the Ohio, where he gave way in a measure to intemperance. In the spring of 1774 his family were massacred, it was alleged, by a party of whites led by Captain Cresap, under the pretext of retaliation for Indian murders; but it is exceedingly doubtful whether Cresap had any connection with the transaction. Logan at once instigated a war against the scattered settlers of the Far West, and for several months fearful barbarities were perpetrated upon men, women and children. He disdained to appear among the chiefs who subsequently sued for peace, but sent by an interpreter to Lord Dunmore, the governor of Virginia, the noted speech explaining his conduct, which was first published in Jefferson's 'Notes on Virginia.' Its authenticity is open to much doubt, however. While intoxicated he attacked a party of friendly Indians and was killed by his relative Tod-hah-dohs in self-defense.

LOGAN, Benjamin, American pioneer: b. Augusta County, Va., about 1752; d. Shelby County, Ky., 11 Dec. 1802. He early crossed the Alleghanies and became a settler in Kentucky. He was an associate of Simon Kenton and Daniel Boone in the Indian fighting then constantly in progress on the frontier. During the Revolutionary War he was also active in the contests between the colonial frontiersmen and the British and their Indian allies. In 1776 he built one mile east of Stanford, Ky., on the site now called Saint Asaph's Spring, the stockade known as «Logan's fort.» When this fort had for weeks in 1777 been besieged by Indians, Logan made his way through the enemy's lines and traveled 150 miles to Holston where he obtained supplies and reinforcements. He participated as second in command in Col. John Bowman's expedition against the Shawnees at Chillicothe, and led the force sent against the Indians under Simon Girty. His advance guard, through over-haste, was defeated at Blue Licks, and Logan himself did not reach the scene of battle until the succeeding day. In 1788 he commanded a force of 600 against the northwestern Indians. He was for many years a member of the Kentucky legislature; and sat also in the State constitutional conventions of 1792 and 1799. His prowess was celebrated on the frontier.

LOGAN, George, American statesman and philanthropist; grandson of James Logan (q.v.): b. Stenton, now a part of Philadelphia, 9 Sept. 1753; d. there, 9 April 1821. He was educated in England, subsequently studied medicine in Edinburgh, where he took the degree of M.D., and afterward returned in 1779 to America. For many years he devoted himself to agricultural pursuits, which he was one of the first in America to prosecute successfully in a scientific manner. He also served several terms in the Pennsylvania legislature. At the outbreak of the French Revolution he embraced with enthusiasm its democratic doctrines, and joined Jefferson and the Republican party in opposition to the Federalists. In 1798, the United States being then on the brink of a rupture with the French republic, he departed for France, under the idea that he might contribute to the preservation of peace. He was well received by Talleyrand and Merlin, then chief of the Directory, and returned to America with the assurance of the desire of the French government to renew amicable relations with the United States. But as he had taken with him letters of introduction from Jefferson and Governor McKean instead of passports from the State Department, he was denounced by the Federalists on his return as the treasonable envoy of a faction who had undertaken to institute a correspondence with a foreign and hostile power. He was coldly received by Washington and President Adams, and in the latter part of 1798 an act, known as the "Logan act," was passed by Congress, making it a high misdemeanor for a private citizen to interfere in a controversy between the United States and a foreign country as he had done. He was subsequently elected to the United States Senate, of which body he remained a member 1801–07; and in 1810, urged by the same philanthropic motives which had induced him to visit France 12 years before, he went to England in the hope of preserving peace. In 1797 he published 'Experiments on Gypsum' and 'Rotation of Crops.'

LOGAN, James, American colonial statesman and author: b. Lurgan, Ireland, 20 Oct. 1674; d. Stenton, near Philadelphia, Pa., 31 Oct. 1751. By his own efforts he acquired a knowledge of the chief ancient and modern languages, and in 1699, being then established in trade in Bristol, England, accepted an invitation from William Penn to accompany him to America in the capacity of secretary. In 1701, upon the return of Penn to England, he was appointed provincial secretary, and subsequently filled the offices of commissioner of property, chief justice and president of the council, discharging in the last capacity the duties of governor of the province for two years after the demise of Governor Gordon in 1736. The latter years of his life were passed at his country-seat called Stenton, in the pursuit of literature and science. His chief work, 'Experimenta et Meletemata de Plantarum Generatione' (Leyden 1739; London, translated from the Latin by Fothergill, 1747), an expansion of a paper on the growth of maize published in the 'Philosophical Transactions' for 1735, was considered an important contribution to the science of botany. He was the author of two other Latin treatises of a scientific character published in Holland, of an English translation of Cicero's 'De Senectute,' published in 1744 by Benjamin Franklin, and of Cato's 'Distichs,' the latter in verse; and he left a variety of papers on ethics and philology. The translation of Cicero was the first original one of a classical author printed in America. His library, numbering about 2,000 volumes, was, in conformity with his desire, presented to the city of Philadelphia, and is deposited in a separate department of the Philadelphia library under the name of the Loganian library. He was one of the founders of the University of Pennsylvania. He was a member of the Society of Friends.

LOGAN, John, Scottish poet and Presbyterian clergyman: b. Soutra, Midlothian, Scotland, 1748; d. London, 25 Dec. 1788. In 1773 he was licensed as a preacher, was in the same year ordained to the second charge of South Leith, and because of his eloquence and fervor in the pulpit soon became popular. In 1783 his tragedy of 'Runnamede' was acted at the Edinburgh Theatre. His association with the stage gave offense to his flock, and owing to this, and to intemperate habits which he had inherited from his father, he was in 1786 constrained to leave the ministry and going to London there engaged in literary work. His name is now best known in connection with that of Michael Bruce and the controverted authorship of the 'Ode to the Cuckoo.' That Logan is entitled to a place among the minor poets of Scotland is sufficiently attested by his exquisite lyrics, 'The Braes of Yarrow.' Consult Anderson, R., 'British Poets' (vol. xi, 1795); and separate edition (1805).

LOGAN, John Alexander, American soldier and politician: b. Jackson County, Ill., 9 Feb. 1826; d. Washington, D. C., 26 Dec. 1886. He studied at Shiloh College, volunteered as a private in the Mexican War, became a lieutenant in the First Illinois Infantry, after the war studied law, was graduated from Louisville University in 1851, was admitted to the bar, and was elected to the Illinois legislature in 1852 and 1856. In 1858 he was elected a representative in Congress as a Douglas Democrat, in 1860 was re-elected, but resigned his seat in 1861, and on 13 September was appointed colonel of the 31st Illinois Infantry. He led this regiment in the attacks on Fort Henry and Fort Donelson, and was wounded at the latter. On 5 March 1862, he was made a brigadier-general of volunteers, and after commanding the 3d division of McPherson's corps (the 17th) in the northern Mississippi campaign, became major-general on 26 Nov. 1862. He fought at Port Gibson, Raymond, Jackson and Champion Hill, commanded the centre at Vicksburg and was appointed military governor of the town upon its capture. In November 1863 he was made commander of the Fifteenth corps, which he led until the fall of Atlanta, save for a short period when in command of the Army of the Tennessee. He then returned to take part in the Lincoln presidential campaign, but rejoined his corps, continued with it till Johnston's surrender, 26 April 1865, and afterward for a time commanded the Army of the Tennessee. In 1866–69 he sat in the 40th and 41st congresses as a Republican. He was one of the managers of the impeachment proceedings against President Andrew Johnson. He was also re-elected to the 42d Congress, but before taking his seat was chosen by the Illinois legislature to the Senate, where he served from 1871 to 1877. He began legal practice in Chicago, but on 18 March 1879 again entered the Senate. While in Congress he distinguished himself by his eloquence. He was consistently opposed to the restoration of Fitz-John Porter to the army, and in June 1880 made a four days' speech on the Porter bill. At the Republican National Convention in Chicago in June 1884, he was a candidate for nomination to the Presidency, and after Blaine's nomination was nominated Vice-President by acclamation. Shortly after the defeat of this ticket, Logan was again chosen Republican senator from Illinois. Blaine said of him: «While there have been more illustrious military leaders in the United States and more illustrious leaders in legislative halls, there has, I think, been no man in this country who has combined the two careers in so eminent a degree as General Logan.» Major-General Logan published a volume on the Civil War entitled 'The Great Conspiracy: Its Origin and History' (1886) and 'The Volunteer Soldier of America' (1888). Consult Andrews, G. F. Byron, 'Biography of General John A. Logan, with an Account of his Public Services in Peace and in War' (New York 1884), and Dawson, 'Life and Services of General John A. Logan' (Chicago 1887).

LOGAN, Olive, American actress, lecturer and author: b. Elmira, N. Y., 16 April 1839; d. Bunstead, England, 27 April 1909. She was educated in Paris and London and fitted for a stage career, which began in Philadelphia in 1854. She appeared at Wallack's Theatre, New York, in 1864, in her own play, 'Eveleen,' retired from the stage in 1868 and became a lecturer on social topics and a contributor to various periodicals. She published 'Chateau Frissac' (1865); 'Photographs of Paris Life' (1861); 'Women and Theatres'; and 'Before the Footlights and Behind the Scenes: a Book about the Show Business' (1870); a metrical translation of Coppée's 'Le Passant' and a dramatization of Collin's 'Armadale.'

LOGAN, Stephen Trigg, American jurist: b. in Franklin County, Ky., in 1800; d. 1880. After studying law and for a while practising in Kentucky he removed (1832) to Springfield, Ill., and there continued in the work of his profession. He became a circuit judge in 1835; was three times (1842, 1844, 1846) elected to the Illinois legislature; and was associated as law partner with Abraham Lincoln, from 1841 to 1844. He was one of those who in 1847 framed the new constitution of Illinois; was again elected to the legislature in 1854; joined the Republican party at its formation, and was a delegate to its national convention in Chicago in 1860, at which Lincoln was nominated. In 1861 he attended the Peace Conference at Washington and then retired from public life. He was regarded as the leading member of the Illinois bar.

LOGAN, Sir William Edmond, Canadian geologist: b. Montreal, 20 April 1798; d. Castle Malgwin, Cardiganshire, Wales, 22 June 1875. He was eduacted chiefly in Edinburgh; was for a time a clerk in London, and afterward became manager of a copper-smelting works in Swansea. While there he devoted himself to the study of geology. In 1840 he went to Canada, and he was the chief of the Geological Survey of that country 1842–70. His writings appeared in the annual reports of the Canadian Survey; in the Proceedings of the British Association, the Geological Society, etc. He published 'Geology of Canada' (1863).

LOGAN, Ohio, village, county-seat of Hocking County, on the Hocking River, and on the Hocking Valley Railroad, about 45 miles southeast of Columbus. It is situated in the natural gas and oil belt, and in the vicinity of some good farm lands. Nearby is found clay suitable for pottery and bricks. Its chief manufactures are flour, furniture, brick for paving and building, pottery, foundry products, sewer pipe, shoes and machinery. The village owns and operates the waterworks. The public library has nearly 3,000 volumes. Noteworthy features are the Cherrington Hospital, Rock House, Rock Bridge and Ash Cave. The village is named after John Logan, the famous Cayuga chief. It was first settled in 1802. Pop. about 4,850.

LOGAN, Utah, city, county-seat of Cache County, on Logan River, and on the Oregon Short Line Railroad and Ogden, Logan and Idaho Interurban Railroad, about 70 miles north of Salt Lake City, by rail, 105 miles. It was settled in 1859 and incorporated in 1866. It is located in an agricultural region with valuable mineral deposits in the vicinity and is surrounded by 30 towns of Cache Valley. The chief industrial establishments are sugar factory, condensed milk factory, knitting mills, flour mills and lumber mills. Some of the educational institutions are the Utah Agricultural College, the Brigham Young College, opened in 1878 under the auspices of the Latter Day Saints, New Jersey Academy, under the auspices of the Presbyterians. The waterworks and electric-light plant are owned and operated by the city. The city government is conducted on the commission plan. Pop. 10,000.

LOGAN, Mount, the second highest peak in North America, Mount McKinley (q.v.) being first, in the southwestern part of Yukon Territory, Canada. Its height is 19,500 feet. It was long considered the highest peak in the continent, but in 1898 the United States Geological Survey found that it was exceeded by Mount McKinley.

LOGANBERRY, a fruit related to the raspberry and blackberry. It was originated in 1881 by Judge J. H. Logan of Santa Cruz, Cal., and is believed to be the result of a cross between a wild blackberry (*Rubus vitifolius*) of California and a red raspberry, probably the Red Antwerp. The fruit is purplish red and very large, and is similar in form to the blackberry, while its flavor is intermediate between those of the parents. Loganberries are cultivated extensively from British Columbia to southern California. They are used fresh as a dessert fruit, and in addition are canned and dried in large quantities. The juice has become a popular beverage.

LOGANIACEÆ, a natural order of corollifloral exogens, consisting of trees, shrubs and herbaceous plants, with opposite entire leaves, and usually with stipules, which adhere to the footstalks to form sheaths. It includes about 30 genera and 400 species and is common in the tropics and in the warmer regions of the temperate zones. The calyx is 4–5 partite; the corolla hypogenous, regular or irregular, 4–5 or 10–cleft. The stamens arise from the corolla. The ovary is generally two-celled; there is one style. The fruit is a capsule, a drupe or a berry. No natural order of plants is more strongly characterized by poisonous properties, especially by strychnine. It includes the *strychnos,* from which is obtained nux vomica and the woorali poison.

LOGANSPORT, Ind., city, county-seat of Cass County, locally known as the "City of Bridges," 77 miles north by west of Indianapolis, where the Eel River flows into the Wabash. The city is an important railroad centre, being entered by the Chicago, Richmond, Bradford and Effner divisions of the Pittsburgh, Cincinnati, Chicago and Saint Louis Railroad; the Michigan division of the Vandalia, and its 94-mile branch northeast of Butler, and by the Wabash. It is also the western terminal of the interurban line operated by the Fort Wayne and Wabash Valley Traction Company and the northern terminal of the line operated by the Indiana Union Traction Company. The business of the city is derived largely from its railroad shops, from its manufactories and from the surrounding agricultural region, and the chief products being wheat, corn, oats and small fruits. There are manufactories of automobiles, radiators, lumber, carriages, plows, flour, baskets, lime, brooms, window shades, soaps and foundry products. Kenneth quarries, two miles west of the city limits on the north bank of the Wabash, furnish large quantities of crushed limestone. The city has several churches. Its educational facilities are embraced in the Logansport Business College, Holy Angels' Academy (R. C.), a high school, the building being of Lake Superior red sandstone, and ward schools, in addition to the Catholic and Lutheran parish schools. The most important public institution is the Northern Indiana Hospital for the Insane, popularly known as "Longcliff," comprising over 34 buildings, and several hundred acres of land. Saint Joseph's Hospital (R. C.), the Home for the Friendless, the Orphans' Home, the Carnegie library, the Federal building, completed in 1905 and costing $75,000, and the Masonic Temple, are among the more prominent institutions. The city also has about 15 acres of parks. The soldiers' monument in Mount Hope Cemetery, costing $10,000, was dedicated 14 July 1887. Logansport was named after Captain Logan, a Shawnee chief, killed by the Indians in November 1812, near the Maumee River, and was first written Logan's Port. The first permanent settlement was made in August 1826 by Alexander Chamberlain, who erected a log cabin on the south bank of the Wabash, directly opposite the mouth of the Eel River. It was incorporated as a town 5 Sept. 1831; as a city, 3 April 1838. Its elective officers consist of a mayor, judge, clerk and treasurer, each for four years, ineligible for two consecutive terms; and seven councilmen, one from each of the five wards, and two at large. The business of the city is largely delegated to its board of public works, which consists of three members, appointed by the mayor, and not more than two of which can belong to the same political party. The police commissioners are appointed by the governor. The city also owns and operates its own electric light and water plant. Pop. 20,262.

LOGAŒDIC, (lŏg'ạ-ē'dĭk), **VERSE.** The derivation of the adjective, logaœdic, from Gr. λόγος (pr. logos = speech, discourse, prose) and ἀοιδή (pr. a-oi-dé = song), the combination giving the sense of prose-song, prose-poetry, shows sufficiently the basic meaning of the phrase. In other words, logaœdic verse is so called because, to some extent at least, its rhythmic effect is supposed to resemble that of prose. Logaœdic verse, as used in Greek and Latin prosody, may be defined as a rhythm, in three-eighths time, based on the trochee (—⏑), but admitting with considerable freedom the use of other feet instead of the trochee. The substitute feet thus generally used are the cyclic dactyl (–́⏑ ⏑), that is, a dactyl in three-eighths instead of four-eighths time; the irrational trochee (—>), which gets its name from the fact that its parts are not, or at least seem not to be, related to each other in the regular ratio of two to one; the triseme (⌞); the tribrach (⏑ ⏑ ⏑); and occasionally, but only in the first foot, or base, of the line, the iambus (⏑ —), the pyrrhic (⏑ ⏑), or the anapaest (⏑ ⏑—). Anacrusis, that is, a short or unaccented initial syllable, occasionally occurs; double anacrusis not so frequently. Throughout this article the sign ∧ indicates a pause or rest.

The principal logaœdic forms are:

I, Dipody (two feet); II, Tripody (three feet); III, Tetrapody (four feet); and IV, Composite: (a) Pentapody (five feet) and (b) verse containing more than five feet.

Examples are:

I. DIPODY.

1. *Adonic* =

–́⏑ ⏑	–́ ⏓
οὐδὲν ετ	ἴκει
ocior	aura

(This may also be scanned –́⏑ | ⌞́⏑ | ⏑́ ∧)

II. TRIPODY.

Pherecratics. These are known as *First* or *Second Pherecratic* according as the cyclic dactyl is the first or second foot.

2. (a) *First Pherecratic* (acatalectic) or *Aristophanic:*

–́⏑ ⏑	–́ ⏑	–́ ⏓
ὃς χαρί	των μὲν	ὄζει
temperat	ora	frenis

This may also be scanned: –́⏑ ⏑ | –́ ⏑ | ⌞́ | ⏑́ ∧

(b) *First Pherecratic catalectic* (not known in Latin, except in composite verse):

–́⏑ ⏑	–́⏑	–́
ψεύδεσι ·	ποικί	λοις

3. (a) *Second Pherecratic* (acatalectic):

–́ >	–́⏑ ⏑	–́ ⏓
δέξε	ται τ'ἐπὶ	μισθῷ
cras do	naberis	haedo

This may also be scanned –́ > | –́⏑ ⏑ | ⏗ | –́ ∧, that is, as a syncopated tetrapody catalectic.

(b) *Second Pherecratic catalectic* (not known in Latin, except in composite verse):

–́ ⏑	–́⏑ ⏑	⏒́ ∧
καίπερ	ἀχνύμε	νος

III. Tetrapody.

Glyconics. These are called *First, Second,* or *Third,* according to the position of the cyclic dactyl.

4. *First Glyconic* (not known in Latin):

–́⏑ ⏑	–́ ⏑	–́ ⏑	–́ ∧
καὶ κυαν	ἔμβο	λοι θο	αἰ

5. *Second Glyconic:*

–́ >	–́⏑ ⏑	–́ ⏑	–́ ∧
πόντου	χειμερί	ῳ νό	τῳ
Sic te	diva po	tens Cy	pri

6. *Third Glyconic* (not known in Latin, except in composite verse):

–́ ⏑	–́ ⏑	–́⏑ ⏑	–́ ∧
φῶτα	βάντα	πανσαγί	ᾳ

7. *Nine-syllable Alcaic* (with anacrusis):

⏒ :	–́ ⏑	–́ >	–́ ⏑	–́ ⏑
τὸ :	δ' ἔνθεν :	ἄμμες	δ' ἂν τὸ	μέσσον
Sil :	vae la	boran	tes ge	luque

8. *Lesser Alcaic* (decasyllabic):

–́⏑ ⏑	–́⏑ ⏑	–́ ⏑	–́ ≥
οἶνον ἐν	εικαμέ	νους με	θύσθεν
flumina	constite	rint a	cuto

IV. Composite: (a) Pentapody.

9. *Lesser Sapphic* (two trochaic dipodies, separated by a cyclic dactyl):

–́ ⏑	–́ ≥	–́⏑ ⏑	–́ ⏑	–́ ≥
ποικι	λόθρον',	ἀθάνατ'	'Αφρο	δίτα
iam sa	tis ter	ris nivis	atque	dirae

10. *Greater Alcaic* (hendecasyllabic; begins with anacrusis):

> :	–́ ⏑	–́ ≥	–́⏑ ⏑	–́ ⏑	⏒́ ∧
οὐ :	χρὴ κα	κόισι	θυμὸν ἐ	πιτρέ	πεν
per :	mitte	divis	cetera	qui si	mul

11. *Phalæcean* (hendecasyllabic):

–́ >	–́⏑ ⏑	–́ ⏑	–́ ⏑	–́ ≥
ἐν μύρ	του κλαδὶ	τὸ ξί	φος φο	ρήσω
cui do	no lepi	dum no	vum li	bellum

Composite: (b) more than five feet:

12. *Greater Sapphic* (third Glyconic and first Pherecratic):

–́ ⏑	–́ >	–́⏑ ⏑	⏗ ‖	–́⏑ ⏑	–́ ⏑	–́ <
fili	um di	cunt Theti	dis ‖	sub lacri	mosa	Troiae

or: –́ ⏑ | –́ > | –́⏑ ⏑ | ⏗ ‖ –́⏑ ⏑ | –́ ⏑ | ⏗ | ⏒ ∧

13. *Lesser Asclepiadic* (second and first Pherecratic catalectic):

–́ ≥	–́⏑ ⏑	⏗ ‖	–́⏑ ⏑	–́ ⏑	⏒́ ∧
ἤλθες	ἐκ περά	των ‖	γᾶς ἐλε	φαντί	νας
Maece	nas ata	vis ‖	edite	regi	bus

14. *Greater Asclepiadic* (this is the Lesser Asclepiadic with a syncopated or catalectic dipody (‖–́⏑ ⏑|⏗) inserted between the two tripodies):

–́ ≥	–́⏑ ⏑	⏗ ‖	–́⏑ ⏑	⏗ ‖	–́⏑ ⏑	–́ ⏑	⏒ ∧
μηδὲν	ἄλλο φυ	τεύ ‖	σῃς πρότε	ρον ‖	δένδριον	ἀμπέ	λω
Nullam	Vare sa	cra ‖	vite pri	us ‖	severis	arbo	rem

Most of Horace's 'Odes' are in logaœdic verse. He adopted his measures from the Greek poets, but in his practice he generally shows greater strictness than his models. Thus, for instance, he always has a spondee (— —) or irrational trochee (—>), instead of a trochee proper (—⏑), before the first occurring cyclic dactyl (–⏑ ⏑). When he uses anacrusis, its quantity is usually long, and in the fourth book of the 'Odes' always so. Catullus, Horace's predecessor, as a rule uses the trochee as the basis of his Glyconic and Pherecratic verse, more rarely the spondee or the iambus. In his Asclepiadic lines he uses the spondee as the basis. Great variety of Glyconic verse is found in Greek poetry. The tragedians use as the basis not only the trochee and the spondee, but also the iambus (⏑—), the pyrrhic (⏑ ⏑), and the tribrach (⏑ ⏑ ⏑), and Euripides even admits the anapaest (⏑ ⏑ —). Sophocles, and more frequently Euripides, secured still greater variety by the displacement of the dactyl and other licenses. Such verses are known as *Glyconei polyschematisti.*

On account of the frequent occurrence of an apparent Choriambus (—⏑⏑—), as, for example, in the Adonic and the Greater Sapphic, logaœdic verses were formerly, and sometimes still are, called Choriambic, and it is possible to scan them so; but it is doubtful if they are truly Choriambic, and it is in conformity with the practice of modern scholarship to name and scan them as logaœdic.

Logaœdic verse is found in English but rarely, and then generally in imitation of a classic form. Thus Tennyson has the following reproduction of the Alcaic strophe:

> O mighty-mouth'd inventor of harmonies,
> O skill'd to sing of Time or Eternity,
> God-gifted organ-voice of England,
> Milton, a name to resound for ages.

And Swinburne has this imitation of the Sapphic strophe:

> Clothed about with flame and with tears, and singing
> Songs, that move the heart of the shaken heaven,
> Songs, that break the heart of the earth with pity,
> Hearing, to hear them.

See Versification.

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LOGARITHMIC (lŏg'a-rĭth'mĭk), **SPIRAL,** the curve described by a point which moves along a uniformly revolving straight line with a velocity proportional to its distance from the fixed point of the line. Its equation in polar co-ordinates is $r = CE^{a\theta}$. It cuts all the radii through the origin at a constant angle, whose tangent is $1/a$. When $a = 0$ the spiral becomes a circle. The evolute of the spiral is an equal spiral. Descartes and Bernoulli studied the properties of this curve and Newton showed that if the force of gravity had varied inversely as the cube of the distance the paths of the planets would have been logarithmic spirals. Consult Bernoulli, J., 'Acta Eruditorum' (1691); Brocard, 'Notes de bibliographie des courbes géométriques' (Bar-le-Duc 1897); id., 'Partie complémentaire' (ib. 1899).

LOGARITHMS. The common logarithm of a number is the index of the power to which 10 must be raised to be equal to the number. Thus $10^3 = 1,000$, so that the logarithm of 1,000 (usually written log. 1,000) is 3. Now $10^1 = 10$, $10^2 = 100$, $10^3 = 1,000$, $10^6 = 1,000,000$, and it is well known that $10^0 = 1$, $10^{-1} = 0.1$, $10^{-2} = 0.01$, etc., thus:

Log. 0.001 = —3
Log. 0.01 = —2
Log. 0.1 = —1
Log. 1 = 0

Log. 10 = 1
Log. 100 = 2
Log. 1,000 = 3
Log. 10,000 = 4

It is evident that the logarithm of any number greater than 1 and less than 10 is fractional; the logarithm of any number greater than 10 and less than 100 is greater than 1 and less than 2. Again, the logarithm of any number less than 1 is negative. The logarithms of numbers have been calculated by Napier, Briggs, Mercator, Newton, Leibnitz, Halley, Euler, L'Houillier, Vlacq, Sherwin, Gardner, Hutton, Taylor, Callet, Schrön, Huntington, Moore and others. Of works giving tables of logarithms we may mention those to which the names of Hutton, Callet and Vega are respectively attached. Chambers' Mathematical Tables is a useful little treatise; it gives logarithms of numbers to seven places of decimals. Suppose we wish to know the logarithm of the number 18.1. In a book of tables we only find the fractional part of the logarithm, it is .257679. Now 18.1 is greater than 10 and less than 100, so that its logarithm is greater than 1 and less than 2; hence log. 18.1 = 1.257679. To give examples:

Log. 18100 = 4.257679
Log. 1810 = 3.257679
Log. 181 = 2.257679
Log. 18.1 = 1.257679

Log. 1.81 = 0.257679
Log. 0.181 = $\bar{1}.257679$
Log. 0.0181 = $\bar{2}.257679$
Log. 0.00181 = $\bar{3}.257679$

$\bar{3}.257679$ means $-3 + 0.257679$. (For a full explanation of the finding of logarithms and natural numbers by tables consult treatises on trigonometry, etc.). The integral part of a logarithm is called its characteristic, the fractional parts its mantissa. Logarithms make arithmetical computations more easy, for by means of a table of them the operations of multiplication, division, involution or the finding of powers, and evolution or the finding of roots, are changed to those of addition, subtraction, multiplication and division, respectively. For instance, if x and y are the logarithms of any two numbers, the 10^x and 10^y; now the product of these numbers is 10 $x + y$, so that the logarithm of the product of two numbers is the sum of the logarithms of the numbers. Again, the quotient of the numbers is 10^{x-y}; so that the logarithm of the quotient of two numbers is the difference of the logarithms of the numbers. Again, 10^x raised to the nth power is 10^{nx}; so that the logarithms of the nth power of a number is n times the logarithm of the number. Again, the nth root of 10^x is $10^{\frac{x}{n}}$; so that the logarithm of the nth root of a number is $\frac{1}{n}$th of the logarithm of the number. Hitherto we have spoken of common logarithms, which were invented by Briggs; their *base*, as it is called, is 10. Now logarithms were first used by Napier of Merchiston (see NAPIER, JOHN), and he employed a base which is smaller than 10, it is the number 2.7182818...., or the sum of the infinite series $2 + \frac{1}{2} + \frac{1}{2\cdot 3} + \frac{1}{2\cdot 3\cdot 4} +$, etc. This base is denoted by e in mathematical treatises, and the Napierian logarithm of any number, say 7, is log. e 7, to distinguish it from log. 7, which is the common logarithm, whose base is 10. The common logarithm of a number is found from the Napierian by multiplying by 0.43429448. Napierian logarithms are of great importance in mathematics.

LOGCOCK, a local name for either of two birds: (1) the pileated woodpecker (see WOODPECKER); (2) the woodcock (q.v.).

LOGGERHEAD SHRIKE. See TURTLE.

LOGGERHEAD TURTLE. See HAWKSBILL.

LOGGIA, lŏj'ạ, a word used in Italian architecture with several significations. It was applied to a hall open on two or more sides, where there were pillars to support the roof. Such are the Loggia de' Banchi in Genoa and the Loggia de' Lanzi in Florence. It is also applied to an open colonnade along the side of a building. The name loggia is also given to the large ornamental window consisting of several parts, which is often seen in old Venetian palaces; and lastly, it is used to designate a small airy hall, usually open on all sides, constructed on the roof of an edifice. See also ARCHITECTURE.

LOGGING, a name given by lumbermen to the practice of rolling logs from whence they are cut, or drawing them on sleds or wagons, to the stream by which they are transported to the mill. In some places logs are thus moved from one point to another by means of flumes and waterways.

LOGIC. Logic is that philosophical science which deals with the principles and methods of all thinking. The processes of thought, although varied in form and content, have always a single end; to interpret the past and the present, and by means of such interpretation to forecast the future. It is by thinking that we are able the better to understand the experiences of to-day and the more wisely to prepare for the events of to-morrow. Any object of thought — a thing, a person, an event — if it is to be really grasped by the thinking mind and to become a part of our body of knowledge, must be correctly interpreted by us. And by interpretation is meant the revelation of its essential significance in the light of the universal principle or the universal nature which the particular object under investigation illustrates. The primary function of logic is this: the interpretation of the particular by means of the universal which underlies it. The development of all logical theory is merely the elaboration of this fundamental principle. To refer any object of consciousness to a universal is the sole method of describing its characteristics, or expressing its significance. If, for instance, I declare a certain plant to be poisonous, I have characterized it by an adjective which admits an indefinite variety of applications but preserves always one and the same essential significance, and this is the meaning and the function of the universal. Any noun which stands for a class or group of objects, or any adjective which may be variously applied, is a universal; or as it is technically known in logic — a concept. Moreover, the reference of any particular object of thought to a universal, i.e., to a concept which serves to interpret it, is a judgment.

Inasmuch as the reference is always confronted with the possibility of error, it is of the very nature of a judgment to raise the question of its truth or falsity, according as the knowledge upon which it is based is accurate or inaccurate, adequate or inadequate. In the manifold conflict of opinion there is an obvious need of some definite and fundamental criterion to discriminate between the true and the false. The final court of appeal as to the truth or the falsity of knowledge must be to the main body of knowledge as a whole. This is the test: does the new experience square with our accumulated experience or not? Truth as regards its logical significance must measure up to the supreme standard, namely, of consistency with all that constitutes the world of knowledge as we understand it. As the judgment is the logical vehicle of expressing truth, it is natural that it should take the form of a reference of the immediate object of consciousness to the general body of knowledge which has been already received, tested and assimilated by the mind. Thus, every new experience is to be illuminated and interpreted by the old. This is the program of thought and the way of all logical procedure and progress. However, there can be no essential progress in thought when the judgment is merely the recognition of the appropriate place of a new thought in our general body of knowledge. Progress is manifest when the object of thought, in the light of our knowledge as a whole, gives rise to some new idea which is not expressed in the given object of thought alone, nor yet in our general body of knowledge alone, but which is nevertheless necessitated and revealed by the combination of the two sources taken together. Our general body of knowledge contributes a part, and the given object of thought contributes the other part. When brought together the two parts fuse into one, forming a complete whole. Thought in this sense is creative. The given elements at hand may be old, but thought constructs them into new forms, ever adding to the store of knowledge from the very elements which knowledge itself furnishes. This process is the consummation of all the various logical functions and is known as the process of inference. Inference is possible because our judgments contain more knowledge than they ever express upon the surface. There is a deposit of knowledge which is implicit in every judgment, and this is due to the fact that all of our judgments are interrelated and interdependent. The complete significance of a judgment is revealed only in the light of all its relevant and cognate judgments. The implicit becomes explicit only when a given judgment is brought into relation to some other judgment which has already been tested and found place in our body of general knowledge; this is what occurs in the process of inference. For instance, if it is asserted that a bar of soft iron will become a magnet if an electric current is allowed to pass through a coil of wire bound about it, such an assertion is based upon our general knowledge which is contained in the judgment that a current of electricity passing through a coil of wire always transforms an iron bar within the coil into a magnet. Without this general knowledge the mere fact of having a coil of wire wound around a piece of iron would be meaningless. To have any significance such a fact must have the light of our general knowledge brought to bear upon it. Then only does the given fact become suggestive and fertile in the increase of knowledge. Or again, if in any triangle there are given the two angles and the included side, one can infer by means of the knowledge of trigonometrical principles the other angle and the remaining two sides. Such a process of inference consists in the combination of what is given with certain general principles which constitute a part of our body of knowledge. That which is given without the general principles to interpret and develop it in all of its implied bearings and relations would remain devoid of significance and with no value as knowledge whatsoever.

In inference, therefore, there is always the extension of our knowledge, for the given judgment contains something which is not apparent when observed in its own light simply, but which is revealed only in the light which plays upon it from our general body of knowledge as a central source of illumination.

The ground of inference, indeed, that which makes the inferential process a possibility at all, is the supposition which we are constrained to make and upon which we are constantly resting, in the exercise of our reasoning faculty, namely, that the various elements which constitute our body of knowledge as a whole must be related to each other in such a way as to form a system of interconnected and interdependent parts. When we have given a single part, other parts of the whole to which the part belongs can be inferred, because of our knowledge of the general system which binds them together through the inner connections of necessity. That which is implicit in any judgment and which forms the germ of inference can be revealed only when one thoroughly understands the complete system of relations and connections which underlies the judgment in question. If our knowledge were not systematized, and the various parts duly related and properly co-ordinated and subordinated each to each, then there could be no basis for any inference, and no possibility of constancy and consistency in our thinking. As aids to systemization there are the processes of definition, division and classification which are treated at length in textbooks on the formal logic and can only receive passing mention here.

While inference depends upon organized knowledge it is also instrumental in producing the very organization of our knowledge itself. It draws from it and at the same time it contributes to it. This twofold function gives rise to the two kinds of inference, known as deductive and inductive. In deductive inference we proceed from our general knowledge to the characterization of the special case which depends upon it; or inasmuch as our general knowledge is expressed in the form of universal concepts we can put it simply — that deduction is from the universal to the particular. Induction, on the other hand, is from the particular case, or rather particular cases, to the universal. It is essentially a process of generalization, by which we rise in thought from the investigation of special cases to the universal principle or law which embraces them and underlies their nature. Inference is always either the interpretation or else the elaboration of knowledge. When that which is given is illuminated by some universal principle or law so that its implicit significance is thereby made explicit, we have the process of deduction. But when there is no recognized universal, and such must evidently be sought, we turn naturally to the relevant instances before us so as to discover in them some suggestion of the desired law or principle. Such a procedure is induction. For example, when the physicist sees certain dark lines in the solar spectrum, he infers that they indicate the presence of iron vapor in the sun. This is deductive inference because it is a process of thought which rests upon the universal and well-known connection between certain definitely positioned lines in the solar spectrum and the presence of iron. On the other hand, however, suppose the investigator is ignorant of the meaning of these dark lines. In his knowledge they possess no significance whatever and suggest nothing to his mind. It is obvious that he must experiment in various ways with the phenomena of these lines until he is able to discover their general relations and significance. Then he will be able to formulate the results of his investigation in a universal law which not only shall embody the special cases coming under his observation but all others also of a similar nature. It will be readily seen that deduction and induction are complementary phases of one and the same process. With every special case which comes before consciousness one of two methods of procedure is possible, that is, if it is to be the subject of inference at all; if it evidently falls under some universal law or principle to which we do not hesitate to refer it, then it becomes invested with the full purport and significance of such a universal; if, however, there is no recognized universal to which we can refer it, the special case presents a problem for us to solve by experiment and observation, namely, what is the universal which we are constrained to believe must underlie it, and which the special case in some way not yet revealed necessarily illustrates. Whenever, therefore, we face a new experience, a new fact or event we must treat it by one or the other of these two methods according as our knowledge is adequate to its interpretation or not. In the one case we are reasoning deductively; in the other, inductively. Where the limitations of knowledge obstruct progress in one direction, it is possible to proceed in the other direction so as to remove eventually these very limitations themselves. If we do not possess sufficient knowledge to suggest the appropriate universal from which to reason deductively, we can proceed in an inductive manner to search for the universal which invites our investigation.

In our thinking these two processes cannot be separated, for some elements in the phenomena under observation appear immediately illuminated by our knowledge, others again are not so illuminated, but when properly tested are found to emit the light which is in them; these various elements are so closely joined together that the two processes must ever run parallel.

The form of inference which best illustrates the deductive reasoning, although by no means exclusively, is that of the Syllogism (q.v.). The syllogism is that method of reasoning which combines two judgments so as to produce a third; as for example:

Whatever turns blue litmus paper red is an acid. This compound turns blue litmus paper red. Therefore, it is an acid.

It will be observed that the two judgments which combine to produce the third have a term in common; this is called the middle term of the syllogism. Moreover, the third judgment or conclusion is proved by the process of eliminating the middle term, and taking as the subject and predicate of the conclusion the remaining terms of the given judgments. The subject of the conclusion is called the minor term; the predicate, the major term, and of the two given judgments, the one containing the major term is called the major premise, and the one containing the minor term, the minor premise. It is the peculiar function of the major premise to exhibit some aspect of our general knowledge, and of the minor premise to exhibit a more particular phase of our general knowledge, or as it more frequently occurs some special case embodied in a concrete experience. It is the combined function of the two together to apply some portion of our general knowledge to a special case so as to yield its true interpretation. It is impossible to discuss here at length the various rules by which the validity of the syllogism may be tested. It may be said, however, that the rules of the syllogism depend upon the fundamental principle that if a special case can be proved to fall within the area of a universal, then the inference follows that the special case becomes invested with the essential characteristics of the universal itself. But if the special case falls outside the scope of the universal, either wholly or in part, then the inference does not follow. For instance, in all cases at law the special case is referred to some law principle, that is, to a universal which completely covers its essential significance and thereby determines the issues of the trial with the attending damages or punishment. Whenever a judicial decision is reversed by a superior court it is because the special case under investigation did not properly come under the law principle to which it was referred. It is obvious that the syllogistic method of reasoning admits of abuse by connecting premises in a merely formal manner which have no real connection. Such an artificial and mechanical treatment of the syllogism leads naturally to empty subtleties and weak sophistries. It was this exclusive emphasis upon the formal and technical side of the syllogism that brought the writings of the schoolmen to such ill repute, so that the term scholastic has become suggestive of a complete divorce of thought from reality. Aristotle, to whom we owe the formulation of the syllogistic method of reasoning, placed supreme stress upon the real connection which must underlie all formal relationship in the structure of the syllogism. Thus he states that «the middle term must express the real cause,’ *τὸ μὲν γὰρ αιτιον τὸ μέσον.* Anal. Post. ii. 2, 90A 6.

The force of Aristotle's observation will be appreciated if we trace the usual process of thought whenever any judgment of ours is questioned. Suppose that one asserts that there is going to be a storm within a few hours, and he is asked concerning the ground of his opinion. The reply would be that there is a rapidly falling barometer, and also that a rapidly falling barometer indicates an approaching storm. Here the middle term, «rapidly falling barometer,» serves to unite the universal judgment to the special case as observed and at the same time to connect the two parts of the reasoning process by a real tie representing the underlying cause upon which they are based. Inference, indeed, is often defined as the process by which the ground of a judgment is explicitly disclosed.

The ordinary categorical syllogism, that is, one which is formed of judgments in the simple form, x is y, although it is essentially grounded in the causal relation, nevertheless in a large measure conceals it. On the other hand, in the hypothetical syllogism, whose major premise is a hypothetical judgment, that is, of the form, if x is y, z is w, and whose minor premise affirms or denies one of these two clauses categorically, the causal relation is brought into the foreground, inasmuch as it states explicitly a consequence as dependent upon its ground. There is still another kind of syllogism known as the disjunctive syllogism in which the major premise is a disjunctive judgment that is of the form, x is either z or w, and the minor premise is an affirmation or denial of one of these alternatives while the conclusion is the corresponding denial or affirmation of the other. This affords a method of reasoning by elimination, and is most useful in deciding between possibilities. In this form of the syllogism the causal relation is not expressed on the surface at all, but is essentially implied; for in order to state possibilities one must know all the underlying causal relations of the system in which these possibilities emerge. For instance, one cannot state that the contents of a stomach which have been chemically examined indicate the presence of arsenic or antimony unless there is known also the exact causal connection between these two poisons and the partially digested food; the disjunctive judgment standing as the major premise of the disjunctive syllogism always presupposes some definite knowledge of determining causal relations which exist in the system under consideration.

The validity of the syllogism turns, as will be readily seen, upon the possibility of referring a special case to its appropriate universal. But there are often situations and circumstances when this method of reference is not at all possible and yet nevertheless a valid inference can be drawn. In other words, the syllogistic procedure by no means exhausts the possibility of deductive inference. There may be other relations which grow out of a system of interconnected parts and which are of such a nature as to warrant an inference from them. For instance, we may have the following inference:

The two angles of a triangle, A and B, equal 95 degrees. Therefore, the third angle must equal 85 degrees.

This is not a syllogism proper and yet is a perfectly valid course of reasoning. While there is no middle term there is an identical point of reference, namely, the given triangle; and there is also the universal upon which the inference depends, namely, the relations which underlie the very nature of the triangle itself and are rendered constant by it. Thus, all of the essentials of inference are found to be present in such a form of reasoning. Various kinds of inference may thus arise according to the different relations which may obtain in the system wherein they occur. To have a valid inference in any such case we must establish some identity of relation between the parts which we are comparing; otherwise we cannot logically pass from one to the other. And identity of relationship can be established only in systems of such simplicity that no unknown elements which might enter to disturb the existing relations can be conceived. Our thought in other words must command the system completely; otherwise we are never justified in using our knowledge as the basis of reasoning.

In the inductive process as we have seen, the procedure is from particular instances to the universal which underlies them and which they illustrate; there is here, however, an evident break in the continuity of the logical process. The conclusion contains more than the premises; for in the universal reached by induction our knowledge goes beyond our actual experience. This is the so-called «inductive leap» or «inductive hazard.» It is not, however, a leap in the dark. Such it would be, were we compelled to use the mere data of experience as the sole ground of our inferences. But it is possible to formulate as a postulate some universal truth which the mind is constrained to assume and which serves to bridge the gap between the particular and the universal. This postulate has been variously expressed by different authors, yet with substantially the same underlying significance in all. In the older logic this is put in the convenient formula of «the uniformity of nature,» that is — beyond the sphere of experience phenomena are supposed to behave under like conditions in the same manner as in the sphere of immediate observation and experiment. In the modern logic, the phrase «uniformity of consciousness» takes the place of «uniformity of nature,» the latter being regarded as somewhat indefinite and as implying a view exclusively objective. By «uniformity of consciousness» is meant, that our knowledge must be consistent throughout with itself, part to part, and parts to the whole, and that the world for us is the world as it is constructed and interpreted by our knowledge. Whenever a concrete instance is present in consciousness it is to be regarded as having its appropriate place in a system of universal and necessary relations, so that a correct interpretation of the concrete case must reveal the universal element which underlies it and gives it a place and meaning in our world of knowledge. Nature after all is only another word for the world as we know it — a world of universal and necessary relations; otherwise it could not be a world of order and uniformity.

The one relation above all others which enables us to discover the universal significance of concrete instances is the relation of cause and effect. When in the phenomena of nature or the events of life, a simple causal relation can be discovered, even though it is illustrated only in a certain case, there is sufficient ground for the generalization of the connection thus discovered. The method of inductive investigation, therefore, consists in various tests for the exhibition of true causal relations of such a simple nature as to furnish evidence that these relations are both definite and constant. A complex relation is too indefinite and variable to warrant any generalization which is based upon it. But however complex the phenomenon may be, it may be always subjected to some process of analysis which will reveal a more simple causal relation underlying it. Moreover, it is necessary by proper inductive tests to discriminate between a causal connection and a mere coincidence. All of this is provided for in the so-called inductive methods — the method of agreement, of difference, of agreement and difference, of concomitant variation and of residues. These are essentially the methods of scientific procedure, the methods of research and experimentation. The function of hypothesis in inductive investigation must not be overlooked. An hypothesis is a supposition which is made concerning the probable cause of a phenomenon either as preliminary to an experiment which may prove or disprove the supposition or in the place of an experiment or systematic observation when such are impossible owing to the peculiar conditions of the phenomenon itself. In the first instance the function of hypothesis determines the line of experiment in a definite manner and does not leave the phenomenon in question to indeterminate and haphazard investigation. This may be illustrated by a quotation concerning Charles Darwin, taken from the 'Reminiscences' of his son, Francis Darwin: "He often said that no one could be a good observer unless he was an active theorizer. It was as though he were charged with theorizing power ready to flow into any channel on the slightest disturbance, so that no fact however small could avoid releasing a stream of theory and then the fact became magnified into importance. In this way it naturally happened that many untenable theories occurred to him; but fortunately his richness of imagination was equalled by his power of judging and condemning the thoughts that occurred to him. He was just to his theories and did not condemn them unheard; and so it happened that he was willing to test what would seem to most people not at all worth testing." ('Life and Letters of Charles Darwin,' Vol. I, p. 126). But there is a second function of hypothesis — where an explanation is needed to account for phenomena which it is impossible to reproduce in the form of an experiment. We are not always able to perceive the relations between facts and yet we are constrained to think of them as related; but in order to systematize them we must supply the *lacunæ* which appear in the phenomena as perceived. A supposition of this nature which is necessary in order to construct a body of facts into a system is an hypothesis — as for instance the nebular hypothesis of Laplace. No course of reasoning, however, can be carried on to any extent or to any effect which does not combine the two processes of deduction and induction in a manner provided for by the complementary relation which they sustain one to the other. The combination of the deductive and inductive processes has been called by John Stuart Mill the deductive method simply. A more distinctive name, however, would be — the inductodeductive method. This combined method consists of three stages:

1. A preliminary process of induction whose results may be expressed tentatively at least in the form of a universal law or principle.

2. A process of deduction based upon this universal principle or law as its major premise, and thus extending our knowledge to the determination of new cases which have not as yet gained a place in our body of knowledge.

3. A process of verification, by which the results of the process of deduction are compared with the facts as actually observed. When there is not an exact correspondence between the theoretically deduced results and the observed facts, and we are able to assure ourselves that there has been no flaw in the processes of deduction, then the original induction stands as so far forth discredited and must be revised so as to square it with fact. This combined method of deduction and induction serves as a check on the one hand upon all tendency to hasty generalization, and on the other it is most valuable as a means of extending our knowledge into unknown regions beyond the sphere of immediate observation. We are constantly using our inductive results as a basis for a deductive inference concerning the things not yet seen; and then when seen, at once comparing the former inference with present fact we are either confirmed in the result which we had reached by the processes of reasoning, or else compelled to discard the earlier inference as false or inadequate as may be. The unseen which we are determining in our minds by what we think the seen necessitates we are, however, from time to time compelled to alter. Bacon has insisted that "anticipations of nature" are a source of innumerable errors and that the truly scientific method consists in the interpretation of nature by means of direct observation and experiment simply. It must be remembered, however, that it is largely through these anticipations of nature that progress in science has been attained. A distinction must be drawn between anticipations of nature which are subjected to careful verification and those which are in themselves regarded as final.

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LOGIC, Symbolic. Symbolic Logic, or Mathematical Logic, or the Calculus of Logic, — called also the Algebra of Logic (Peirce), Exact Logic (Schröder), and Algorithmic Logic or Logistic (Couturat), — covers exactly the same field as Formal Logic in general, but differs from Formal Logic (in the ordinary acceptation of that term) in the fact that greater use is made of a compact symbolism — the device to which mathematics owes so largely its immense development.

Formal Logic may be defined as that science which has for its object the complete analysis and systematic presentation of the principles and methods of deductive reasoning, or the type of reasoning in which conclusions are drawn from given premises. It is not concerned with the truth of the premises or of the conclusions, but simply takes care that if the premise is true the conclusion shall be; it is the study of the forms of valid inference without regard to the content or subject matter of the propositions which are inferred or of those from which the inference is drawn. Symbolic Logic is then that treatment of Formal Logic which employs, instead of many of the words of ordinary language, a system of special symbols which secure not only greater precision and compactness, but also greater generality in its discussions. These symbols, like the symbols of mathematics, form, in reality, a new symbolic language; and it may be said that the choice of a convenient and accurate symbolism has been, in logic as in mathematics, an indispensable condition for the progress of the science.

A partial use of symbolism in Formal Logic is as old as the time of Aristotle; for example, “If both A and B include the whole of C, it follows that some A is B.” What is called Symbolic Logic simply carries this device farther; it would express the whole of the above statement in symbols, as, for example, thus: $A \succ C . B \succ C . \prec A \curlyvee B$. The immense advantage that accrues from the full carrying out of this idea of Aristotle's can only be realized by those who have given some attention to mastering the details of the method.

The thorough-going application to Formal Logic of the symbolic method, with the accompanying extension of the field of logical inquiry, is a development of the latter half of the 19th century. The essential features of the modern theory, to be sure, were known to Leibnitz as early as 1700, and some valuable contributions were made by Lambert in 1781; but the first work which brought the possibilities of the symbolic method forcibly to the attention of logicians was 'An Investigation of the Laws of Thought' by George Boole, in 1854; and Boole is commonly regarded as the founder of the modern science. The new ideas did not at first meet with favor; the logicians, wedded to the classical methods, in which reasoning is carried on by means of living words, refused to admit what they called a mathematical intrusion into their science; while the mathematicians on their side regarded the whole movement as of no possible interest except to logicians. The field remained for some decades a no-man's land between mathematics and logic; the few who cultivated it worked largely without knowledge of previous or contemporary workers in the same field; and the difficulty of defining the relation of logical symbolism to mathematical form, and the limits of the analogy between them, led to many errors. By the end of the century, however, owing to the labors of Peirce and Schröder, the new methods had established themselves on a sound footing, and had proved their value in logical investigations. To mention only the illustration of their power, the Syllogism, and the so-called "laws of thought" (namely, the principle of identity, the principle of contradiction and the principle of excluded middle), have now been completely analyzed by the symbolic method, with results for which most logicians were not prepared: in the first place, it is now known that the three "laws of thought" are entirely independent of one another, in the sense that no one is a necessary consequence of the other two; secondly, that the principle of the syllogism, in its primitive form, is not a consequence of the other three laws, but must be assumed as a separate principle; and finally that all four of the laws taken together are not sufficient for some of the most elementary processes of mathematical reasoning — that for these an entirely different discipline is required, namely, the Logic of Relations (see below). This example alone is sufficient to justify the assertion that the study of Symbolic Logic has put a wholly new spirit into the Logic of Aristotelian traditions, and has transformed a discipline which had remained nearly stationary since the Middle Ages into one of the most progressive of the modern sciences.

While this development was taking place in logic, an equally important movement in a similar direction was being carried forward in the field of Pure Mathematics, and a brief account of this movement must be given before we can understand the present position of Symbolic Logic. Up to the middle of the 19th century, mathematics had been so busily engaged in testing the power of the newly acquired calculus of Newton and Leibnitz, and obtaining results by its aid, that few inquiries had been made into the logical foundation of the theory. Since that epoch however, increasing attention has been paid to these fundamental questions, among the early leaders being such men as Bolyai, Lobatchevsky, Cauchy, Weierstrass, Reimann, De Morgan and Robert Grassmann, all of whom, except the first two, were contemporaries of Boole's. The first result of these inquiries was the recognition, more clearly than ever before, that every mathematical theory is based on a small number of fundamental hypotheses, or postulates, from which all the other propositions of the theory can be deduced, and careful lists of postulates are now being worked out for most of the important mathematical branches. Secondly, it became increasingly evident that the real interest of the mathematician lies not so much in the material content of the hypotheses which he assumes, as in the logical processes by which further propositions are deduced from those hypotheses. The natural outcome of this conviction was an immediate and very great extension of the field of mathematical inquiry. No longer confined to the study of number, quantity and space, mathematicians invented for themselves new systems of hypotheses, and deduced from them new theories. Any set of postulates would serve, provided they involved no internal contradiction, and in the exuberance of new freedom the subject matter was sometimes chosen with an almost playful disregard of practical utility. Perhaps the most striking example of the new tendency was the acceptance of the non-Euclidean geometries of Lobatchevsky and Bolyai as legitimate branches of mathematics. These theories had at first been regarded as heretical, or at least as non-mathematical; but now, when it became clear that their assumptions, though unusual, were still not self-contradictory, they were assigned their proper places as hypothetical-deductive theories; they therefore became as much a part of mathematics as the older theory of Euclid, that theory being itself now recognized as a hypothetical-deductive theory; and the mathematical interest of either theory was seen to be quite independent of the question whether an illustration of it could or could not be found in the world of space-perceptions. Another example is that of Hamilton's quaternions, which is a new algebra in which the fundamental assumptions differ in several respects from the laws which hold in the more familiar algebra of quantity. Similarly, all the host of artificial algebras, the invention of which was promoted especially by Hankel (1867) and Benjamin Peirce (1870), are hypothetical-deductive theories exhibiting varying degrees of divergence from the ordinary algebra of quantity; perhaps the simplest of all these algebras is that invented by Boole himself for the purposes of symbolic logic. In arithmetic and geometry the work of Peano, Padoa and Pieri in Italy, and of Pasch, Frege and Hilbert in Germany, should be especially mentioned. Finally, the theory of abstract groups, and the whole operational calculus, are outgrowths of the same tendency. In short, pure mathematics came to be regarded, at the end of the century, as a collection of hypothetical-deductive theories, distinguished from one another by the nature of the assumptions adopted as the basis of each theory, but depending for their mathematical interest not so much on the material content of those assumptions as on the logical relations between the resulting propositions.

As the outcome of these two movements, therefore, the sciences of logic and mathematics found themselves in a wholly unexpected position at the beginning of the 20th century. Instead of being separate, almost antagonistic, disciplines, they suddenly discovered that they were both working in the same direction — that their problems and aims were identical. The field of symbolic logic, which had hitherto occupied a rather uncomfortable position between the two opposing forces, now became the common meeting-ground where mathematicians and logicians can work together to mutual advantage. The researches of Peirce and his pupils in America, and of Schröder in Germany, became more widely known. Peano and his school in Italy began the publication of the 'Formulaire de Mathématiques,' which is intended to become a complete cyclopædia of mathematical knowledge, expressed in the language of symbolic logic. Russell and Whitehead in England, and Couturat in France, became active exponents of the new mathematical-logical theory. Even the strictly mathematical researches of Georg Cantor began to arouse lively interest among the logicians. Finally, it remained for Russell (1903) to announce the surprising thesis that logic and mathematics are in reality the same science; that pure mathematics requires no material beyond that which is furnished by the necessary presuppositions of any logical thought; and that formal logic, if it is to be distinguished as a separate science at all, is simply the elementary, or earlier, part of mathematics.

It is too early to predict what the final outcome to this new movement will be; the limits of the inquiry are not yet well defined; the terminology and notation are still in an experimental stage; many important matters of detail are likely to remain for some time in debate; but at any rate this much is clear: a new program has been proposed for mathematics and logic, and the true nature and scope of what is now called symbolic logic cannot be finally determined until this broader question of the relation between logic and mathematics is decided. It may be that, in the merging of these two sciences, no place will be left for symbolic logic as a distinctive science; it may be that the studies now pursued under that name will be supplied with a more appropriate title; or it may be that some new form of symbolic logic will absorb the whole of logic and mathematics.

In view of these considerations it is clear that any account of the subject which can be given at the present time must be regarded as tentative and transitional — a snap-shot at a rapidly moving phenomenon — certain to become obsolete with the change of perspective which is taking place in all our mathematical-logical notions. The sketch which now follows, after this long introduction, must therefore be understood as containing not a body of universally accepted facts, but merely the writer's individual selection of some of the results which, in their view, seem most likely to become of recognized value.

The main results which Symbolic Logic claims to have secured are briefly the following:

1. A thorough-going investigation into the foundations of logic,— an enumeration of appropriate groups of first principles (axioms and postulates) and the deduction from them of the whole structure.

2. The furnishing of a wonderfully concise and compact method of expressing premises and deductions from premises. It is impossible to overestimate the mastery which this gives over trains of thought.

3. A method for putting any number of premises, of any degree of complexity, into the intellectual mill, and extracting *all* the information which they convey about any term or any combination of terms, without the fatigue of conscious reasoning. Machines have been devised, like Jevons' "Logical Piano," by which these conclusions can be reached (not, however, in interesting forms) without even the aid of paper and pencil. The only difficulty is to find any *real* problems that are hard enough for this branch of the subject to attack.

These results have been due to:

(*a*) The generalization of the relation *is*, *implies* (made possible by the convention that "all *a* is *b*" does not involve the existence of *a*; this generalization is due to Leibnitz).

(*b*) The introduction of the logic of *and* and *or* (there is no reason why logic should not discuss, e.g., equivalences — perfectly common in real life — such as "The undevout astronmer is mad = Any astronomer is either mad or else devout").

(*c*) The introduction of the Special Terms, 0 and ∞ (nothing and everything, or the non-existent and the existent).

(*d*) The excision of the non-valid syllogisms, and hence the reduction of valid syllogisms to a perfectly symmetrical collection, all (universal and particular) tested by one simple and easy rule.

(*e*) The introduction of an appropriate symbolism.

As has already been intimated, much of the new matter of modern logic has no necessary connection with its symbolism. The first four of the above improvements could perfectly well have been attained without its use; that they were not is the greater proof of the utility and power of the symbolic method.

For the purposes of more detailed exposition, the subject may be divided into three parts:

(1) The Logic of Classes or Concepts;
(2) The Logic of Propositions; and
(3) The Logic of Relations;

although this can hardly be called a scientific division. (The use to which the term "Algebra of Logic" is now commonly restricted will be explained below).

1. The Logic of Classes or Concepts.— In conducting any scientific inquiry, we usually, whether consciously or unconsciously, confine our attention to a particular realm of thought, which may be called the universe of discourse, or simply the *universe*, for that particular inquiry; any object outside the universe is irrelevant to the discussion. For example, astronomy deals with the universe of material objects on a large scale; anthropology deals with the universe of human beings; botany deals with the universe of flowers and plants; etc., etc. This universe, in any particular discussion, is represented by the symbol ∞, or by the symbol 1.

Within any given universe, we have to speak of classes, a *class* being a group of objects of thought which are distinguished in any way from the rest of the universe. The objects belonging to a class are usually characterized by the possession of certain common characters in which we are interested; and of these characters we then may form a "concept." But in Symbolic Logic we view a class merely as (in any way whatever) distinguished from the other classes of the universe.

Any class is represented in symbolic logic by a letter of the alphabet, and the complementary class, comprising all the rest of the universe, by the same letter with a dash or accent. Thus, in the universe of men, we may let $a =$ the class of Americans, $b =$ the class of bankers and $c =$ the class of Californians; then a' will represent the class of all foreigners, b' the class of all non-bankers, and c' the class of all men who do not live in California. Of course it is possible at any time to enlarge the borders of our universe, so that, for example, b' may come to mean not only all men who are not bankers, but also all things of any kind which are not bankers, as microbes, demonstrations, virtues. In any case, two classes x and x' together exhaust the universe considered, and have no part in common; either of two such classes is called the *negative* of the other. When a criterion, or means of distinguishing the objects of a class x from the rest of the universe, is so defined that no object in the universe will satisfy this criterion, it is convenient to speak of x as an "*empty*" or "*null*" class. Any null class is represented by the symbol 0. Thus, the class of all plane figures which are at the same time round and square, and the class of all prime numbers which end in the digit 4, are examples of null classes.

The common part of two classes x and y is represented by xy, and is called their *logical product*. Thus, in our example, $ab =$ the class of American bankers, $a'b =$ the class of foreign bankers, $a'c =$ the class of foreign Californians (this last being of course a null class).

The class composed of two classes x and y together (whether or not these classes overlap) is represented by $x + y$, and is called the *logical sum* of x and y. Thus, $a + b =$ the class containing all Americans and all bankers; $a + a'b$, or the class containing all Americans and all foreign bankers, is of course the same class.

When two classes x and y are given, it may happen that every element of x is also an element of y; this relation is represented by $x \prec y$, and is the *fundamental relation* which may exist between two classes. Thus, in our example, $c \prec a$, since every Californian is also an American. If it happens that $x \prec y$, and at the same time $y \prec x$, we write $x = y$; that is, the symbol $=$ in logic is merely an abbreviation for two reciprocal relations $\prec$ between the terms which it connects.

Obviously $x \prec \infty$, whatever x may be; if it happens also that $\infty \prec x$, then and then only it will follow that $x = \infty$. Similarly the equation, $x = 0$ is equivalent to the two relations $0 \prec x$ and $x \prec 0$, the first of which, like $x \prec \infty$, is tautologous, being true for every value of x.

We give next, without proof, a list of the principal theorems which have been discovered concerning the fundamental notions represented by ∞, 0, x' xy, $x + y$, and $x \prec y$. (The names attached to some of the theorems are the outgrowth of a varied and uncertain history, and do not always suggest very clearly the meaning of the theorem).

1. $a \prec a$. (Principle of identity).
2. If and only if $a \prec b$ and $b \prec a$, then $a = b$.
3. If $a \prec b$ and $b \prec c$, then $a \prec c$. (Principle of the syllogism; see also theorems 22 and 23, below).
4. $a + a = a$ and $aa = a$. (Tautology).
5. $a + ab = a$ and $a(a + b) = a$. (Absorption).
6. $a + b = b + a$ and $ab = ba$. (Commutative laws).
7. $(a + b) + c = a + (b + c)$ and $(ab)c = a(bc)$. (Associative laws).
8. $a + (bc) = (a + b)(a + c)$ and $a(b + c) = (ab) + (ac)$. (Distributive laws).
9. $a \prec a + b$ and $ab \prec a$. (Simplification).
10. If $a \prec y$ and $b \prec y$ then $a + b \prec y$; and if $x \prec a$ and $x \prec b$, then $x \prec ab$.
11. If $a \prec bc$, then $a \prec b$ and $a \prec c$; and if $b + c \prec a$, then $b \prec a$ and $c \prec a$.
12. If $a \prec b$, then $a + b = b$ and $ab = a$.
13. If $a \prec b$ and $x \prec y$, then $a + x \prec a + y$ and $ax \prec ay$.
14. $0 \prec a$ and $a \prec \infty$.
15. $a + 0 = a$ and $a \infty = a$.
16. $a + \infty = \infty$ and $a0 = 0$.
17. $aa' = 0$ and $a + a' = \infty$. (Principle of contradiction, or exclusion; and principle of excluded middle, or exhaustion).
18. If $x \prec a$ and $x \prec a'$, then $x = 0$; and if $a \prec y$ and $a' \prec y$, then $y = \infty$.
19. $(a')' = a$. (Double negation).
20. If $a \prec b$, then $b' \prec a'$. (Contraposition).
21. $(a + b)' = a'b'$ and $(ab)' = a' + b'$. (De Morgan's Theorems).
22. If $ax + bx' = 0$, then $= 0$.
23. If $(a + x)(b + x') = \infty$, then $a + b = \infty$. (Theorems 22 and 23 are other forms of the principle of the syllogism).

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24. $\infty = 0$. (Postulate of existence).
25. $\infty = a + a'$

$$\begin{aligned} &= (a + a')(b + b') \ldots \\ &= ab + ab' + a'b + a'b' + \ldots \\ &= abc + a'bc + ab'c + \ldots \end{aligned}$$

and $0 = aa' = aa' + bb' = aa' + bb' + cc' + \ldots$. (Formulæ for the complete development of ∞ and 0).

26. $(pab + qa'b + rab' + sa'b')' = p'ab + q'a'b + r'ab' + s'a'b'$.

(Formula for obtaining the negative of a well-developed expression,— of great utility in the ~~solution of problems).~~

In verifying the truth of these theorems, the familiar Eulerian circles may render some service by exhibiting to the eye the relations of the several terms; but Euler's diagrams become inadequate and even misleading in any really fundamental discussion, because they fail to represent satisfactorily the negative term, the complete introduction of which into modern logic is one of the most important enlargements of the subject. A better method of diagrammatic representation has been proposed by Venn (*loc. cit.*).

2. The Logic of Propositions.— We now turn to the second division of our subject, which will prove to be not a separate branch of the theory, but merely another aspect of the branch already considered.

In this branch of the subject, letters are used to represent not classes, but propositions, and the notation $x \prec y$ is used to express the relation: "the proposition x *implies* the proposition y" or "the truth of x entails the truth of y.» For example, if p = the proposition that John Smith endorsed this protested note, and q = the proposition that he is liable for its payment, then $p \prec q$. Here, as in the logic of classes, the notation $p = q$ is used to express the double relation $p \prec q$ and $q \prec p$. When p is any proposition, then p', or p with a dash above it, represents the proposition contradictory to p, which is called the negative of p.

The notation pq, called the ***logical product*** of p and q, represents a proposition the assertion of which is equivalent to the simultaneous assertion of the propositions p and q; and $p+q$, called the ***logical sum*** of p and q, represents a proposition the assertion of which is equivalent to the alternative assertion of the propositions p and q. For example, if p = «the testator was of sound mind,» q = «he acted freely,» and r = «his will is admitted,» then $pq \prec r$, since the simultaneous assertion of p and q is sufficient to prove the truth of r (or, in the contrapositive form of the statement, $r' \prec p' + q'$); it happens that in this particular case we have also $p' + q' \prec r'$ (or its equivalent, $r \prec pq$), since if either p or q is false, the will is disallowed. Hence we may embody the complete statement of the situation in the equations $pq = r$ (or $p' + q' = r'$); but it must be constantly borne in mind that every such equation stands for the simultaneous assertion of two statements, the one a sufficient and the other a necessary condition.

Finally, the symbol ∞ is used in this theory to represent any typical true proposition, such as $2+2=4$; and the symbol 0 is used to represent any typical false proposition, such as $2+2=5$. These symbols enable us to express the assertion of the truth or falsity of any proposition as follows: $\infty \prec p$ is equivalent to the assertion «p is true», and $p \prec 0$ is equivalent to the assertion «p is false.» Obviously $0 \prec x$ and $x \prec \infty$ whatever the value of x; so that the relations $\infty \prec p$ and $p \prec 0$ may be replaced by $p = \infty$ and $p = 0$, respectively. Two propositions, p and p', will be contradictory when and only when $p + p' = \infty$ and $pp' = 0$.

If now we proceed to give the theorems which hold concerning the notions we have just represented by ∞, 0, x', xy, $x + y$, and $x \prec y$, we shall find that all the theorems 1–26 given in the previous section for the theory of classes hold also here, if the symbols are interpreted according to the theory of propositions. For example, the theorem: «If a class a lies within the common part of two classes b and c, then it lies within b and also within c,» and the theorem: «If a proposition a implies the simultaneous assertion of the propositions b and c, then it implies c and also implies b,» are each expressed by the same symbolic form, namely, (11): «If $a \prec bc$ then $a \prec b$ and $a \prec c$.» And so for each of the other theorems. This remarkable similarity between the theory of classes and the theory of propositions was stated by Leibniz, but was first fully developed by Boole.

As a most interesting example of the way in which compound propositions can be handled by the Logic of Propositions, we mention Mrs. Ladd-Franklin's «inconsistent triad»:

$$(ab=0)\ (b'c=0)\ (ac \neq 0) \prec 0;$$

since this is the form to which all the 8,192 valid syllogisms (both universal and particular) can be reduced. By transposing the third factor, we have the universal syllogism: $(ab=0)\ (b'c=0) \prec (ac=0)$; and by transposing the second factor we have the particular syllogism: $(ab=0)\ (ac \neq 0) \prec (b'c \neq 0)$; the «inconsistent triad» thus furnishes a perfectly general rule for testing the validity of any syllogism.

The Logic of Classes and the Logic of Propositions are included together in the 'Algebra of Logic' of Peirce and Schröder; in recent years, however, the term «Algebra of Logic» has come to be used in a more mathematical sense, which will be explained in the following section.

The Algebra of Logic, Strictly so Called. — If we define *terms* in general to be any objects of thought which can be elements of an asserted relation — whether simple terms, like classes or concepts, or compound terms, like propositions, relations between propositions, etc.— we may say that the logic of classes and the logic of propositions have, formally, the same fundamental notions to deal with, namely: (1) terms, represented by letters of the alphabet; (2) two special terms, 0 and ∞; (3) three functions of terms: negations (x'), sums ($x+y$), and products (xy, or $x \times y$); and (4) the primitive relation between terms, expressed by $x \prec y$, which may itself (in its non-assertive form) be a term of a compound proposition; moreover, the theorems 1–26 are true formulæ in the one theory as well as in the other.

The theorems 1–26 are therefore capable of at least two interpretations: first, in the theory of classes, and secondly, in the theory of propositions; and there are doubtless many other theories also in which these formal statements can be given a concrete significance. It, therefore, becomes a natural inquiry to investigate this body of theorems in their abstract form (that is, without specifying any interpretation for the symbols), to study the logical relations that exist among them, and to select certain of them as fundamental, from which all the others can be deduced as formal consequences. The body of theorems so considered, with their consequences, forms a mathematical algebra, called (in distinction from the algebra of quantity, the algebra of complex numbers, the algebra of abstract groups, etc.) the *algebra of logic*. The algebra of logic bears the same relation to the ordinary algebra of quantity that the non-Euclidean geometries bear to the ordinary geometry of space; and it has been the analogy between the algebra of logic and the algebra of quantity that has led to the importation of several mathematical terms into the study of symbolic logic (as «zero,» «sum,» «product,» etc.). The study of the algebra in this abstract form has brought out relations between the propositions of logic which might perhaps otherwise have remained unnoticed. As an example, it has been shown that the six fundamental notions: ∞, 0, x', xy, $x + y$, $x \prec y$ are not independent of one another, but that all may be defined in terms of any one of the last three; thus, theorems 15, 16, 17 and 12 may be used as definitions of ∞, 0, x', and $\prec$ in terms of + and $\times$; while theorems 9 and 10 show how ab and $a+b$ can be defined in terms of $\prec$. Indeed it is hard to see how questions of the independence of the fundamental notions could have been discussed at all without the aid of the abstract algebraic method.— The most readable expositions of the algebra of logic from its mathematical side are given by Whitehead and Couturat (see *Bibliography*). A searching inquiry into the nature of the algebra, and its relation to other branches of mathematics, was begun by Kempe in 1890, and has recently been carried farther by Royce (1905).

The Logic of Relations.—The Logic of Relations, or the Logic of Relatives, was founded, as regards first principles, by De Morgan (‘Trans. Camb. Phil. Soc.,’ Vol. X, 1864), developed by Peirce, carried further by Schröder, and has now met with what is possibly a farther important development in the hands of Russell (1903). We can give, in this space, only a cursory account of the principal terms which are employed.

In many inquiries we are concerned with the relation in which some term stands to some other term; for example, a number x may be less than a number y; a person A may be a debtor of a person B; a circle M may lie within another circle N: the notions “less than,” “debtor of,” “within,” are *relations*. Every relation has a *converse* relation. For example, if x is less than y, then y is greater than x; if A is a debtor of B, then B is a creditor of A; if M lies within N, then N includes M. It is customary to represent a relation by a capital letter, as R, and the inverse relation by the same letter with a curved dash above it, as $\breve{R}$. Thus if R stands for “less than,” and $x=3$ and $y=5$, we have: xRy and $y\breve{R}x$. Again, if R stands for “parent of,” $\breve{R}$ will stand for “child of.”

If xRy and ySz, then x stands in a certain relation to z, called the *relative product* of the relations R and S and denoted by RS. Thus if xRy stands for “x is brother of y,” and ySz for “y is father of z,” then $xRSz$ will signify “x is uncle of z”; or again, $xRSz$ may mean “x is an agent of a landlord of z,” etc.

If a relation R is such that xRy always implies yRx, then R is called a *symmetrical* relation. For example, the relations “equal to,” “different from,” “spouse of,” are symmetrical relations. If R is such that yRx is false whenever xRy is true, then R is called an *asymmetrical* relation; as “less than,” “father of,” etc. Relations like “sister of,” which are neither symmetrical nor asymmetrical, are called simply not-symmetrical.

A relation R which is such that xRx for every value of x is called a *reflexive* relation, like the relation of equality, or the relation which we have devoted by $\prec$ in the preceding part of this article (see theorems 1 and 2).

Again, if a relation R is such that xRy and yRz together always imply xRz, then R is called a *transitive* relation. For example, “less than,” “less than or equal to,” “ancestor of,” etc., are transitive relations. The asymmetrical transitive relations are more important than any other relations in the exact sciences; for example, “less than,” “below,” “before,” “prior to,” are relations of this type. The recent paper by Royce, however, shows how the theory of these asymmetrical relations can be made to depend on the theory of a certain more fundamental symmetrical relation.

In conclusion, we may notice that the whole theory of arithmetical operations, like addition and multiplication, may be regarded as a part of the theory of relations; for, as M. Bôcher has pointed out, instead of saying: “two numbers a and b determine a third number c, called their sum,” we may say: “the three numbers a, b, and c satisfy a certain relation, say $R(a, b, c)$.” Relations of this type are more complicated than those described above, since they hold not between two terms, but between three or more terms.

Bibliography.—The most extensive treatise on this subject is E. Schröder's ‘Algebra der Logik,’ in four volumes, begun in 1890; the last volume is being published posthumously by E. Müller. J. Venn's ‘Symbolic Logic’ (1881, 2d ed. 1894) is especially valuable for its historical references. The ‘Manuel de Logistique,’ by L. Couturat, contains the clearest exposition of the whole subject, with an account of the most recent progress. A. N. Whitehead's ‘Universal Algebra’ (1898) and L. Couturat's ‘L'Algèbre de la logique’ (1905) treat the algebra of logic from the mathematical point of view. J. N. Keynes, in his ‘Studies and Exercises in Formal Logic’ (1894), has developed the subject without mathematical formulation, but in a very useful way for one who approaches it from the point of view of the logician. Other references are the following: ‘Opuscules et fragments inédits de Leibniz,’ ed. L. Couturat (1905); Lambert, J. H., ‘Neues Organon’ (1764); De Morgan, A., ‘Formal Logic’ (1847); Boole, G., ‘Laws of Thought’ (1854; see above); Macfarlane, A., ‘Algebra of Logic’ (1879); Johnson, W. E., ‘Mind’ (new series, Vol. I, 1892); McColl, H., ‘Proceedings London Mathematical Society’ (Vol. IX, 1877), and later papers; Peirce, C. S., *American Journal of Mathematics* (Vols. III, IV; VII), ‘Proceedings American Academy of Arts and Science’ (Vols. VII, X, XIII), ‘Memoirs’ of the same (Vol. IX), ‘Studies in Logic by Members of the Johns Hopkins University’ (1883); Ladd, Christine (Mrs. F. Franklin), ‘Studies in Logic, etc.’ (1883), and later papers; Mitchell, O. H., ‘Studies in Logic, etc.’ (1883); Frege, C., ‘Begriffsschrift’ (1879); Müller, E., ‘Ueber die Algebra der Logik’ (1900–01); Peano, G., ‘Formulaire de Mathématiques’ (1895, and later editions); Huntington, E. V., ‘Transactions American Mathematical Society’ (Vol. V, 1904); Kempe, A. B., ‘Proceedings London Mathematical Society’ (Vol. XXI, 1890); Royce, J., ‘Transactions American Mathematical Society’ (Vol. VI, 1905); Russell, V., ‘Revue de Mathematique’ (Vol. VII, 1901); ‘Principles of Mathematics’ (Vol. I, 1903).

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LOGIER, lō'zhyā, **Johann Bernhard**, German-English inventor and musician: b. Cassel, Germany, 1777; d. Dublin, 1846. In 1787 he was taken to England, where he learned to play the flute and piano. For some time he was member of the band of an Irish regiment, subsequently becoming organist of a church at Westport (Cathair-na-Mart), Ireland. He wrote several pieces for the piano, but came into general notice through his invention of the chiroplast, an apparatus designed to assist beginners in piano-playing. He also evolved a simplified method of instruction for this and other instruments. His inventions and method divided music teachers into two groups and Logier took advantage of this publicity to further the sale of his inventions and amassed a large fortune within a short time. From 1821 to 1824 he taught his system in Berlin at the request of the government. He retired to his home near Dublin in 1826. His most popular work was ‘Practical Thoroughbass’ (1818).

LOGISTICS, the name given by the Greeks to the art of computation which they distinguished from their arithmetic, the latter term being applied by them to the theory of numbers; in military science, logistics means the art of moving troops, in which is comprised the details of marches and the fixing of places for encampments and cantonments together with estimates for ammunition and other supplies.

LOGOGRAM, an abbreviation or sign for a word, especially in phonography or shorthand, as $ = dollar; .) = establish. It is also a form of anagram in which the maker seeks to find all the words that may be made from all or some of the letters of a word. The whole is interspersed in a series of verses which contain synonyms of these words. To resolve the puzzle the concealed words must be named and also the primary word from the letters of which they have been formed.

LOGOGRAPHERS, or LOGOGRAPHI, among the ancient Greeks the designation of writers of prose histories prior to Herodotus. In Thucydides, however, the term is applied by this author to all his predecessors. Almost all of these writers were Ionians who wrote in their native dialect. Their works were merely crude attempts to reproduce in prose the current legends and traditions, genealogies, manners and customs, etc., treated in the great epics. There was no criticism, scientific or otherwise, in these narratives and they appear to be intended rather to amuse their readers than to impart accurate historical knowledge. The principal logographers were Cadmus of Miletus, Pherecydes of Leros, Hecatæus of Miletus, Acusilaus of Argos, Charon of Lampsacus, Xanthus of Sardis in Lydia, Hellanicus of Mytilene, Stesimbrotus of Thasos, Hippys and Glaucus, both of Rhegium, Damastes of Sigeum. Logographers also were called those orators who composed pleadings and sold them to those who required them in the law courts and who were forbidden to employ advocates. The extant fragments of the logographers, with Latin notes, translation, prolegomena and copious indices, are contained in Müller, C. W., ‘Fragmenta historicorum Græcorum’ (1841–70). Consult Bury, J. B., ‘The Ancient Greek Historians’ (New York 1909).

LOGOGRAPHI. See LOGOGRAPHERS.

LOGOS (Greek λόγος, from λέγειν, to speak), word, language, speech in general. Language being peculiar to man as a reasonable being, and speech presupposing thought, *logos* signifies reason, the faculty of thinking in general. Thus *logos* has the meaning both of thought and utterance. In Christian theology this term, as used in certain passages of the Scriptures, has been the source of continual disputes ever since the 3d century of our era. The passage in the Bible which gives rise to this discussion is the opening of the Gospel of Saint John: “In the beginning was the Word, and the Word was with God, and the Word was God. The same was in the beginning with God. All things were made by Him, and without Him was not anything made that was made,” etc. In the Greek text the expression here translated “Word” is *logos*. What is here to be understood by *logos*, what is its essential character, whether it is a person of the Deity or not, the creative intellect of God, or the Son, through whom He created, or the divine truth which was to be revealed, etc., this is not the proper place to examine, nor will our limits permit us even to enumerate the different opinions which have been entertained on this interesting point of Christian metaphysics. We can refer the reader to no better source of information than Neander's ‘General History of Christianity and the Church.’

The generally received doctrine of the *logos* makes it a person and not a mere name, and maintains that the Word is called *God*, not by catachresis but in the strict and rigorous meaning of the term; that the most ancient Fathers of the Church always taught the divinity of the Word and that they derived the idea from the Holy Scriptures alone and not from the Platonic philosophy as many have asserted. On the contrary, it is held that the Hebrew conception of the *logos* is of independent origin, though it was natural that in the New Testament the Greek word should be adopted to express it.

Some of the opinions of modern theologians on the meaning of the *logos* are as follows: It is necessary, some say, in order to understand the true meaning of *logos*, to begin with the examination of Wisdom (*sophia*), which was prevously used to express the same notion. (Consult the book of Proverbs, viii, 1, seq., and the book of Wisdom, vii, 22, seq.). The poetical author of the Proverbs does not imagine a person separate from God, but only an interior power of God, because in his time there could be no idea of a being proceeding from God, the Jews having borrowed this notion at a later period from the Oriental doctrine of emanations. The author of the book of Sirach (xxiv, 3) first uses “The Word” (*logos*) of God as equivalent to “Wisdom” (*sophia*), to signify the almighty power of God. The Word being an act of wisdom gave rise to the symbol. John speaks of the *logos* in the beginning of his Gospel only, and afterward uses the expression *pneuma tou theou*. From his representation, the following positions have been deduced: the *logos* was (a) from the beginning of all things (comp. Proverbs viii, 22; Sirach xxiv, 9); (b) from the beginning with God (comp. Sir. i, 1; Wisd. Sol. x, 16; ii, 14; Sir. xxiv, 12). Saint John, therefore says, those who thus interpret him had the same idea of the *logos* as the apocryphal writers; for the circumstance that the latter ascribe to the *logos* the creation of all things, while Saint John leaves this point undecided in his *en archē ēn* (in the beginning was), does not amount to a contradiction. Others, particularly the earlier commentators, understand by *logos* the Deity himself, that is, the second person of the Deity (according to Saint John viii, 58). But those who adhere to the former opinion maintain that this is in contradiction to John xiv, 28; xii, 49, 50; v, 19, 20; and that he understood by *logos* only a power of God, which was communicated to Jesus, on account of which he could claim divine attributes and yet call the Father, as the source of this power, greater than himself. Others, as Herder, Paulus, Eckermann, understand by *logos* the Word of God, which in the Old Testament, as the expression of the will of God, is the symbol of his creative power (Gen. i, et seq.). The later Jews represented the divine omnipotence by the Word of God. But it is maintained, on the other hand, from the manner in which John speaks of the *logos*, that he understood by it not merely omnipotence, but the Omnipotent. Others following the Fathers of the Church, particularly Eusebius, understand by *logos* an independent substance, external from God, like the *nous* (intellect) of Plato. But this again, it is said, involves an error, because Plato means by *nous* only a power of God. Still others, as Mosheim and Schlegel, declare with Irenæus the *logos* of Saint John to be identical with the *logos* of the Gnostics; but it is objected that John did not conceive of a plurality like that in the doctrine of æons. Lange considered *logos* equivalent to the *sophia* of the Old Testament, and that to the *logos* of Philo, and as a distinct person from God; but, say the others, *sophia* is not something distinct from God. Paulus, in his Commentary, also identifies the *logos* of Philo with that of Saint John. But it is said, on the other hand, that John cannot be supposed to have been acquainted with Philo's notion, as it was not an opinion current at the time, and that the view of the apocryphal writers is more in harmony with his; moreover, that if Saint John means anything more than an original, external power in God, his «was God» (Saint John i, 1) would imply dualism. Döderlein and Storr translated the word *logos* by *doctrina*, the abstract being put for the concrete, *doctrine* for *teacher*, as in Gen. xlii, 38; 2 Sam. xxii, 23; Luke iv, 36. According to others, *ho logos* means *ho legomenos* (the promised). The ancient philosophers often distinguish two *logoi* an interior in God or man which merely thinks (*logos endiathetos*), and an exterior or uttered (*logos prophorikos*). Consult Aall, 'Der Logos' (Leipzig 1896); Allen, A. V. G., 'Continuity of Christian Thought' (London 1907); Harnack, 'History of Dogma' (ib. 1894-99); Inge, W. R., in 'Dictionary of Religion and Ethics'; and 'Personal Idealism and Mysticism' (ib. 1907); Mackintosh, 'The Doctrine of the Person of Christ' (London 1912).

LOGROÑO, lō-grō'nyō, Spain, capital of the province of Logroño, on the Ebro, 30 miles southeast of Vittoria. It is surrounded by ancient walls and ramparts, has a 12-arch bridge over the Ebro, erected in 1138, an arcaded street, an immense bull-ring seating 11,000 persons, and a very ancient church of Santa Maria de Palacio, dating according to tradition from the time of Constantinus Magnus. Logroño has a large wine trade. In pre-Roman times the district belonged to the Berones. From the Romans it received in succession the names of Juliobriga and Lucronius. In the 8th century it fell to the Moors, but they were soon driven out. In 1521 the city was besieged by the French unsuccessfully and from 1808 to 1813 French forces occupied it. The dumb painter, Juan Fernandez Navarrete, was born here in 1526. Pop. 23,900.

LOGROSCINO, lŏ'grō-shē'nō, **Nicolo**, Italian composer: b. Naples, 1700; d. 1763. He wrote several operas in which he developed the opera-buffa style and concluded several in ensemble, an innovation which has since become the custom. His operas are. 'Inganno per Ingamno' (1738); 'La violante' (1741); 'Il governatore' (1747); 'Giunio Bruto' (1750); 'Tanto bene, tanto male'; 'Il vecchio marito'; 'La furba burlata' (1760). Consult Kretzschmar, H., 'Zwei Opera Nicolo Logroscinos' (in *Jahrbuch der Musikbibliothek Peters*, Leipzig 1908).

LOGUE, lōg, **Michael**, Cardinal, priest of the Roman Church and primate of all Ireland: b. Raphoe, 1 Oct. 1840. Before he was yet a priest he filled the chairs of theology and *belles-lettres* in the Irish College, Paris, where he was ordained in 1866. Returning to his native diocese of Raphoe in 1874, he was consecrated its bishop five years later. The chair of Saint Eunan in the early '80's was no mere seat of «learned leisure» for its occupant and for his flock in famine times he in one year collected close on £30,000 ($150,000). The parish priests of Armagh chose him as coadjutor to Primate McGettigan in 1887, their choice was approved by Rome and he became within a few months archbishop and primate of all Ireland. His elevation to the cardinalate in 1893 was a dignity never before attained in the line of 108 primates from Saint Patrick. Like his English compeer, Cardinal Vaughan, who received the red hat at the same consistory, he has labored strenuously for his own cathedral, the memorable consecration of which took place in the presence of the papal legate in July 1904. Cardinal Logue visited the United States and Canada in 1908, and was present at the ceremonies in celebration of the centenary of the archdiocese of New York. A second visit was made to America two years later. An omnivorous reader and a close student and follower of public affairs, he is an admirable though not a prodigal speaker; and is a keen student of nature, a lover of the sea and an expert yachtsman. Cardinal Logue is a representative of the old school of conservative Irish churchmen, whose policies and ideas differ widely from those of the younger clergy of the Ireland of to-day.

LOGWOOD, the heart-wood of *Hæmatoxylon campechianum*, a leguminous tree which grows wild, in most places, along the eastern shores of Mexico and Central America. From its abundance in some parts near the Bay of Campeachy it is sometimes called Campeachy-wood. The leaves are pinnate; the flowers small, yellowish and disposed in auxiliary racemes at the extremity of the usually spinous branches. The wood is red, tinged with orange and black, so heavy as to sink in water, and susceptible of receiving a good polish; and it yields an extract much used in dyeing. (See Dyes). Though cultivated to some extent in Jamaica, the logwood of commerce is chiefly obtained from Honduras, where the cutting of it forms an extensive but unhealthy branch of business. Haiti and Santo Domingo also produce much. The finest kind comes from Campeachy, the inferior qualities from Honduras and from Jamaica, to which island it is not indigenous although it grows abundantly since its introduction. In the preparation of this wood for use, the trees, which are 20 to 50 feet high, are cut down, the bark and alburnum removed and the hard centre parts cut up into three-foot logs. It is afterward hewn into much smaller pieces, and ground or rasped to small chips. The aqueous extract is muddy and of a reddish-brown color. By acids the red color is made paler; by alkalis it is converted to purple. Salts of iron, aluminum and lead give precipitates of a blue, violet or purple color. Logwood is chiefly consumed in dyeing cotton cloth, silk, wool and leather; by mordanting the fabric with iron, black is produced; with alumina, violet and lilac; with copper, blue; and with chromium, a black or green — the exact tint depending on the composition of the mordants and logwood liquors, and the mode of application. The coloring power of logwood depends chiefly on a crystalline ingredient called *hæmatoxylin* (q.v.). In medicine both the extract and the decoction of logwood are used to some extent. The former is prepared by exhausting the wood with boiling water, filtering and evaporating to a thickish syrup; the latter is the water extract of the wood along with some cinnamon. Both are used as astringents in diarrhœa and dysentery.

LÖHE, lė'ĕ, **Johann Konrad Wilhelm,** German divine and philanthropist: b. Fürth, near Nuremberg, 21 Feb. 1808; d. Nuremberg, 2 Jan. 1872. He received his éducation at the universities of Erlangen and Berlin and in 1831 was appointed vicar at Kirchenlamitz. Here his fervent evangelical preaching won him general attention and also caused his removal by the authorities on a charge of mysticism. A similar experience awaited him at Saint Egidia, Nuremberg; in 1837 he became pastor at Neuendettelsau, where his work transformed the community and made his name and fame international. Fearing spiritual dangers for the Germans emigrating to the United States he founded two missionary training houses for them. He founded the Lutheran Society of Home Missions in 1849 and an institution of deaconesses in 1853. He also founded a lunatic asylum, a Magdalen refuge and hospitals. He was a forceful preacher, being gifted with a fine physical presence and a powerful voice. He wrote 'Sieben Predigten' (1836); 'Sieben Vorträge über die Worte Jesu am Kreuze' (1859) and other volumes of sermons; also 'Samenkörner des Gebets' (36th ed., 1899); 'Drei Bücher von der Kirche' (1845; 4th ed., 1904); 'Von der weiblichen Einfalt' (13th ed., 1903). Consult Deinzer, J., 'Wilhelm Löhes Leben' (3 vols., Gütersloh 1873; 3d ed., Nuremberg 1901).

LOHENGRIN, lō'ĕn-grĕn, a romantic opera in three acts, both music and words by Richard Wagner; first performed at Weimar, Germany, on 28 Aug. 1850; first production in America, 3 April 1871, at the Stadt Theatre, New York; in London, 1875. In this, perhaps the most popular of all his operas, Wagner draws his material from the old 13th century legend of the Holy Grail. The scene is laid near Antwerp, early in the 10th century. The German suzerain, King Henry (the Fowler) has arrived to levy troops, and finds a general commotion. Count Frederick of Telramund accuses the fair Elsa of Brabant of having killed her young brother, Godfrey, heir to the late Duke of Brabant, who had left the two children in Telramund's charge. The latter has married Ortrud of Friesland and lays claim to the duchy of Brabant. Elsa is innocent of the crime imputed to her and declares that her brother was taken away. The king resolves to decide the case by a tourney or ordeal by combat, in which Telramund must fight any champion who may take up the gauntlet on behalf of Elsa. The latter has no champion; in strong faith she tells of a heavenly knight she had dreamed of who would come to her aid, and publicly declares she will bestow her hand and crown upon her defender. In answer to her prayer a boat drawn by a swan appears on the water, bearing a gallant knight in silver armor. He agrees to fight for her on two conditions — that she shall marry him, and never ask his name, to both of which Elsa pledges herself. Telramund is quickly thrown in the contest, but the knight spares his life. Telramund and his wife are both outlawed; it is she in fact who has stolen the boy and then told her husband that she had witnessed his murder by Elsa. Seeking revenge, Ortrud appeals to Elsa's sympathy and fills the girl's mind with suspicions about her lover. The knight and Elsa are married, in which scene occurs the famous wedding march. In the third act the couple are alone when Elsa, prompted by the incitements of Ortrud, asks her husband the fatal question. Telramund bursts into the room, sword in hand, but is stricken down dead by the knight, who now leads his wife before the king and announces that she has broken her pledge; he must now divulge his name and leave her forever. He proclaims himself to be Lohengrin, the son of Percival, and a knight of the Holy Grail. The swan reappears with the boat; when Ortrud declares that she had changed young Godfrey into a swan by sorcery. Lohengrin utters a prayer — the swan changes again into the missing boy; Lohengrin glides away in the boat — drawn by a dove, and Elsa falls broken-hearted in her brother's arms.

LOHSE, lō'zĕ, **Otto,** German orchestral leader: b. Dresden, 1859. He received his artistic training under Draeseke, Wüllner, Grütsmacher and Richter at the Dresden Conservatory of Music. In 1877–79 he was cellist in the Court Orchestra at Dresden and in 1880–82 was piano teacher at the Vilna Imperial Music School. Subsequently he was conductor of the Wagner Society of Riga where in 1889 he was made conductor of the new Municipal Theatre. Four years later he was made first conductor of the Hamburg opera. In 1895–97 he made a tour of the United States as conductor of Damrosch's German Opera Company. In 1897–1904 he was general musical director at Strassburg and in the latter year removed to a similar post at Cologne.

LOIGNY, lwä'nyē', France, village in the department of Eure-et-Loir, 43 miles south by west of Paris. It was the scene of a battle during the Franco-Prussian War, on 2 Dec.

1870. The Grand Duke of Mecklenburg gained a great victory over the French under Chanzy. The French lost 15,000 in killed, wounded and prisoners and the Germans 4,200. The Germans as a result of the victory at Loigny were enabled to move on Orléans, which soon afterward fell into their hands.

LOIR, lwär, France, a river which rises in Eure-et-Loir, flows southwest for a distance of 186 miles and debouches into the Sarthe. It has been rendered navigable for a total distance of about 70 miles.

LOIRE, lwär′ (anc. *Liger*), France, the largest river of the country, dividing it into two nearly equal portions. It rises on the western slope of the Cévennes, in the department of Ardèche, and flows generally northwest and west to its outlet in the Bay of Biscay below Nantes. Its principal affluents on the right are the Arroux, Nièvre, Maine, etc.; on the left the Allier, Vienne, Cher, Indre, etc. Below Nantes, it is more a tidal estuary than a river, and is studded with islets. Above Nantes navigation is much impeded by shallows. Its whole course is about 645 miles, of which about 450 miles are navigable. The river is subject to disastrous inundations, and dikes (levées) have been constructed along its course. It is connected by canals with the Saône, Seine and Vilaine.

LOISY, lwä-sē′, **Alfred Firmin,** French ecclesiastic and exegete: b. Ambrières (Marne), 28 Feb. 1857. Of peasant extraction, he attended the school of his native village. Two prizes, one in history and one in orthography, which he received in his last year at school (1868), drew attention to him and led to his being sent to the college at Vitry. The Franco-Prussian War interrupted his studies and returned him to his family; but in October of the following year we find him back at college, this time, however, at Saint Dizier. During a religious retreat he conceived the desire of becoming a priest and, rather against the wishes of his family, entered the Grand Séminaire of Châlons-sur-Marne, without taking his degree. Among his instructors was Abbé Ludot, who fell under the suspicion of insinuating into his students the ideas of Montalembert and Lacordaire. In November 1878, after he had been ordained subdeacon, Loisy was designated by his bishop, Monsignor Meignan of Chalons, later cardinal-archbishop of Tours, to continue his studies in the newly organized Institut Catholique in Paris. He did not, however, enter into the spirit of the new foundation, and in less than two months returned to his seminary at Châlons, where in June of the next year (1879) he was ordained by special papal dispensation a priest in the 23d year of his age, and at once appointed curé of Broussy-le-Grand and later of Landricourt, the latter quite near his native Ambrières. Academic studies being more to his liking, however, than parochial duties in a small curacy, Loisy obtained the permission of his diocesan to resume his interrupted course at the Institut Catholique. Here he threw himself with such ardor into the study of Hebrew and Biblical exegesis that in little more than a year he was given a lectureship in Hebrew, to which was added in 1883 a course in Old Testament exegesis based directly on the Hebrew text, and in 1886 still another in Assyriology. All the while he was engaged on his own dissertation for the doctorate ('Histoire du Canon de l'Ancien Testament'), which was published in 1890. Already therein he exhibits a bias toward the new Scriptural criticism which later on was defined by papal encyclicals as «Modernism.» The tendency was so marked in his next work, «Les mythes Chaldéens de la création et du déluge» (1892), that the seminarians of Saint Sulpice were forbidden to attend his lectures. His dismissal from the Institut followed the appearance of a number of articles of adjudged modernistic trend in the *L'Enseignement biblique,* a bi-monthly, written throughout and published by himself. This publication he voluntarily suppressed shortly thereafter on the issuance of the encyclical «Providentissimus Deus» of Pope Leo XIII, which condemned the very critical views championed by Loisy. A retirement for the next five years to the chaplaincy of a girls' school at Neuilly-sur-Seine, under the direction of a convent of Dominican nuns, afforded Loisy the necessary leisure to perfect his apologetic method and prepare for his weighty articles in the *Revue d'histoire et de littérature religieuse* and the *Revue du clergé français* under various pseudonyms, until, after the appearance in the latter of the first of a series of articles on «*La religion d'Israel*» (October 1900), Cardinal Richard forbade their acceptance. Separated from the Institut and denied the clerical journals, Loisy asked and obtained leave from the Minister of Instruction to give courses in the École des Hautes Etudes, which he continued until 1904. The works of Loisy which brought him most sharply in conflict with the Church were 'La Religion d'Israel' (1901); 'Etudes évangéliques' (1902); 'L'Evangile et l'Eglise' (1902, Eng. trans. 1903); 'Autour d'un petit livre' (1903), an elaboration of the views expressed in the preceding work; and 'Le quatrième Evangile' (1903). All these books were condemned by the Congregation of the Index on 4 Dec. 1903. Five years later he was excommunicated on the publication of 'Les Evangiles synoptiques.' He thereupon ceased the attempts he had previously made at reconciliation with the Church, discarded the clerical garb and accepted the chair of history of religions in the Collège de France. Among the modernistic French clergy in the last decade of the 19th century and the first of the 20th Loisy was the very storm centre of the movement, carrying its critical exegesis to the logical conclusion of denying to the Church all vestige of dogmatic *magisterium* in the traditional sense. Yet throughout the whole period of his most active participation in the movement, at least up to the moment of his formal excommunication, he stoutly maintained his devotion to the See of Peter and the Church for which it stands, '*Catholique j'étais, catholique* *reste,*' he wrote to Bailey Saunders in 1 ('*Quelques Lettres,* p. 21); but he a «*Critique j'étais, critique je reste.*» His frie and foes alike, both within his communion without it, expressed surprise at this attit Yet it was not that he was merely stradd the fence. His anomalous position is perh understandable from the nature of «L'Evangile et l'Eglise' to Harna des Christentums.' Against the antism of Harnack that the essence of Christianity, being the interior and individual realization of God in the human soul, does at the present time not only not need an organized church, which, at all events has deteriorated from its pristine purity, but is perhaps better off without it, Loisy strenuously maintained the necessity of the church's being a genuine organization, with all hierarchic and governing machinery, with sacraments and means of grace, ordained by God and directed by Him, whose specific function it is to mediate God to the inward man, of course, but to mediate Him through externalities and symbols, and whose function thus to mediate God ever becomes more perfect. Harnack conceives the transformations through which the Church has past under the metaphor of a stream issuing from a pure fountain, but becoming polluted by the soils through which it flows and discolored and vitiated by the tributaries that pour into it; Loisy, who claimed to regard the development of the Church in the same light as Newman did, looks upon these transformations as necessary and inevitable, as much so as those of a tree from the seed. But he leaves Rome when he refuses to admit that this Church was really founded by Christ in the form it later assumed. Rather he regards it as the eschatological «kingdom,» which in the designs of God was to become the repository of faith by a process of development, but which the historical Jesus of the Gospels, when that narrative is stripped of later Christian accretions, knew naught of, nor could know aught of, because He was unconscious of divine consubstantiality with the Father and assumed the Messianic rôle only in the sense in which it was understood by the Jews of His time. It was only with the Council of Nicea that Jesus was recognized to be, in the words of its Creed, «true God of true God; begotten not made; consubstantial with the Father.» With this explanation of the development of the Gospel, Loisy was prepared to accept the whole authoritative teaching of the Roman Catholic Church. The objection usually brought against Loisy's method of apologetics, by Catholic as well as Protestant opponents, is that, whereas he professes to be a historical critic, he is rather a rationalistic philosopher; that instead of reasoning from critically authenticated facts of history, he puts reason above history, whence too readily that which is thought to be counter to reason is necessarily assumed to be unhistorical and fictitious.

Bibliography.— A sympathetic biographical sketch is furnished by Alfred Dêtrez, 'L'Abbé Loisy: Biographie critique, etc.' (1909) containing a bibliography of Loisy's books and principal articles, and some critical references. Fair but adverse criticisms of Loisy's views may be found in Sterrett, J. M., 'The Freedom of Authority' (1905) and Lepin, M., 'Les Théories de M. Loisy: Exposé et Critique' (1909). Consult also Pesch, C., 'Theologische Zeitfragen' (4 Folge, 1908); Lilley, A. L., 'Modernism' (1908); Bampton, J. M., 'Modernism and Modern Thought' (1914); Gisler, A., 'Modernismus' (2d ed., 1912).

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LOJA, lō'hạ, or **LOXA**, Ecuador, capital of the province of the same name, situated near the southern frontier of the republic, in a beautiful valley and at an elevation of nearly 7,000 feet. The climate is moderate, due to the great elevation. The city has a cathedral and a college. Its industrial establishments are limited to woolen mills. Gold, silver and copper are mined in the vicinity; stock raising is carried on with success and cereals, sugar, cotton and tobacco are grown in the surrounding district, giving the city a large trade in these articles and their products. Alonzo de Mercadillo founded Loja in 1546. Pop. about 10,000.

LOJA, or **LOXA**, Spain, town in the province of Granada, situated 30 miles west of the city of that name, on the Genil, and on the Granada-Algeciras Railway. The town is built on the slope of a hill atop which is a Moorish citadel. It contains two ancient churches and a modern ducal palace. Coarse woolens, leather, paper and silk are manufactured. Loja was a place of great military importance during the struggle with the Moors and was strongly fortified by the latter, being one of the two keys to Granada. Loja is first mentioned in Arab chronicles of 890 A.D. It was taken by Ferdinand III in 1226; was afterward abandoned, fell to the Moors, who lost it to Ferdinand and Isabella after a siege on 28 May 1486. A fine Moorish bridge and many ancient dwellings were destroyed by the earthquake of December 1884. Pop. 18,900.

LOKEREN, lŏ'kĕr-ĕn, Belgium, town in the province of East Flanders, situated at the southern end of the district called Pays de Waes, on the Durme, 20 miles south of Antwerp. It contains a fine church dedicated to Saint Laurent, is well built and has manufactures of cottons, damasks, chemicals, linen and tobacco. The neighboring region until 1830 or thereabouts was merely a sandy moorland, but has been rendered one of the most fertile regions of Belgium, producing grain, hemp and flax, in which articles the town has a large trade. Lokeren, like other towns of Belgium, suffered severely from the German invasion and occupation (1914–18). The machinery of its factories was either destroyed or transported to Germany, its industries being thus destroyed. Pop. 22,600.

LOKI, lō'kē, in mythology, the god of strife and spirit of evil. He artfully contrived the death of Balder, when Odin had forbidden everything that springs «from fire, air, earth and water» to injure him. The mistletoe, not being included, was made into an arrow, given to the blind Höder, and shot at random; but it struck the beautiful Balder and killed him. This evil being was subsequently chained with 10 chains, and will so continue till the twilight of the gods appears, when he will break his bonds; then will the heavens disappear, the earth be swallowed up by the sea, fire shall consume the elements, and even Odin, with all his kindred deities, shall perish.

LOKMAN, lŏk-män', a name that figures in the proverbs and traditions of the Arabians. According to tradition Lokman was a scion from the stock of Ad, and was once sent with a caravan from Ethiopia to Mecca to pray for rain in a time of great drought. But God's anger destroyed the whole family of Ad except Lokman, the only righteous one, whereupon the Creator of the world gave him his choice to live as long as the dung of seven gazelles, which lay in an inaccessible hole in a mountain, should last, or for a period equal to the lives of seven successive vultures. Lokman chose the last, and lived for an almost incalculable length of time. The fables bearing the name of Lokman were for the first time made known to Europe through the press in 1615. They were first published in Arabic, with a Latin translation, were afterward appended to an Arabic grammar, published by Erpenius at Leyden, and have since gone through many editions. The most complete manuscript of the fables of Lokman is in the library of the Vatican, in Persian.

LOLA MONTEZ. See Montez, Lola.

LOLACH. See Lepidosiren.

LOLIÉE, lō'lyā', **Frédéric Auguste,** French essayist and critic: b. 1856. Always devoted to literature he has written a great number of works the majority of which deal with comparative literature. He has been the recipient of several prizes from the French Academy. Among his principal works are 'Nos gens de lettres' (1887); 'Le paradoxe' (1888); 'Les immoraux' (1891); 'Dictionnaire des écrivains et des littératures' (1897); 'Histoire des littératures comparées' (1905; Spanish and English translations); 'Les femmes du Second Empire' (1906; English and German translations); 'La comédie française, histoire de la maison de Molière' (1906); 'La fête impériale' (1907; English and German translations); 'La vie d'une impératrice' (1908; English and German translations); 'La comtesse de Castiglione' (1912).

LOLLARDISM, lŏl'ạr-dĭzm, in Great Britain, the tenets of the followers of John Wyclif. The views of Wyclif underwent a process of development as his researches and experience extended, and were by no means the same at all periods of his life. In so far as they departed from Roman Catholicism, they approached and, in some cases, went beyond what subsequently became the doctrine and discipline of Calvinism or Puritanism, commingled with an antagonistic element, Erastianism; in a large measure they reconciled the English people later to the establishment of the Reformation. Among the articles pronounced «heretical» by an assembly of ecclesiastical notables, convened in London in 1382 by William Courtnay, archbishop of Canterbury, were these:

> " 1. That the substance of material bread and wine doth remain in the Sacrament of the Altar after consecration.
>
> " 3. That Christ is not in the Sacrament of the Altar truly and really in His proper corporeal person.
>
> " 5. That if a man be only contrite, all exterior confession is to him superfluous and invalid.
>
> " 7. That it hath no foundation in the Gospel that Christ did ordain the mass.
>
> " 8. That if the Pope be a reprobate and an evil man, and consequently a member of the devil, he hath no power over the faithful of Christ given to him by any, unless, peradventure, it be given him by the emperor.
>
> " 9. That after Urban VI. none other is to be received as Pope, but that Christendom ought to live after the manner of the Greeks under its own laws.
>
> " 10. That it is against the sacred Scriptures that ecclesiastical persons should have any temporal position."

Among 14 articles adjudged to be «erroneous» were the following:

> " 13. That a prelate or bishop excommunicating a cleric who hath appealed to the king or the council of the realm, in doing so is a traitor to the king and the realm.
>
> " 15. That it is lawful for any deacon or presbyter to preach the Word of God, without the authority or license of the Apostolic See, or of a Catholic bishop or of any other recognized authority.
>
> " 17. Also that temporal lords may at will take away their temporal goods from churches habitually delinquent.
>
> " 18. That tithes are pure alms, and that parishioners may for the offenses of their curates detain them, and bestow them on others at pleasure, and that tenants may correct delinquent landlords at will.
>
> " 24. That friars are bound to get their living by the labor of their hands, and not by begging.

Consult Gairdner, J., 'Lollardy and the Reformation in England' (3 vols., London 1908–11); Powell and Trevelyan, 'The Peasants' Rising and the Lollards' (London 1899).

LOLLARDS, lŏl'ạrdz, a name which arose in the Netherlands in the 14th century, and which during that and the following century was applied somewhat indiscriminately as a term of contempt to various sects or fraternities deemed heretical by the Roman Catholic Church. Different accounts are given of the derivation of the name. According to one opinion the name was first applied to a fraternity formed about the year 1300 at Antwerp, the members of which devoted themselves to the care of the sick and the burial of the dead, and were called Lollards from the Low German *lollen* or *lullen,* meaning to sing in a low tone, from the subdued and plaintive dirges that they were in the practice of singing while accompanying dead bodies to the grave. According to another opinion the name was first bestowed upon the followers of one Walter Lollard, who preached peculiar doctrines both in England and on the Continent between 1315 and 1322, till in the latter year he was burned as a heretic. Whatever may have been the origin of the name, it became well known in England about the end of the 14th century, when it was applied to the followers of Wyclif. See Lollardism; Wyclif.

LOLOS, lō'lōs, an ancient people, so called by their neighbors, holding a large, mountainous territory in the western edge of Sze-Chouan, China, and hitherto almost unknown, by reason of their savage exclusiveness. They formerly occupied, with the Miao-tze (q.v.) and other primitive tribes, an extensive region in southwestern China conquered from the local autocthones; but they were themselves conquered by the Chinese in Yunnan in the 14th century, and more completely subjugated about 1727 by the Manchu power. A part of the Lolos then succumbed to circumstances and remained in Yunnan, where they still form a large but humble part of the population. Great numbers of the tribe, however, migrated to the wild, elevated region in western Sze-Chouan between the Blue River (Yang-tze Kiang) and the Great Snowy Mountains along the border of Tibet, where they set up a community of independent clans with a feudal social system. Their hereditary chiefs, however, were originally appointed by China, and acknowledge vassalage to China, although refusing admission to their country, or any sort of obedience, to Chinese officials. They go boldly among the Chinese — are in fact great wanderers; but no stranger is permitted to enter Lolo territory except by arrangement with a native prince who will guarantee his good behavior and final exit. It was only by accommodating himself tactfully to this custom that Vicomte D'Ollone, to whom we owe most of our knowledge of this secluded race, was enabled to travel in Lolo Land.

The Lolos are in race allied to the eastern Tibetans. They are tall and powerfully built, most of the men exceeding six feet in height; have straight, vigorous forms, a complexion resembling that of a swarthy Greek or South Italian, with the eyes large and protected by well-arched eyebrows, the nose aquiline, the mouth shapely, and a self-assured expression and demeanor. Their country has a cold and stormy climate, and the dress of the men is much like that of the Chinese, but each man carries habitually a mantle of thick felt which is his wrapping by day and his bed by night. The women are tall, with regular, often handsome features, and a frank and cheerful disposition, and wear garments singularly like the ordinary dress of European women, often of rich materials procured from the Chinese. Their hair is tastefully arranged, and covered out of doors by a silken turban. The serving class is, of course, much more simply appareled. Soldiers wear a kind of armor, and carry swords, lances and bows, with a few in possession of poor guns. They travel and fight mainly on horseback, and are skilful riders on their small, tough horses.

The social system is purely feudal. A powerful family has attached to it a group of hereditary serfs that attend to the simple farming and care of livestock, of which a large amount is kept, including pigs and chickens. They are assisted by slaves. These slaves are the captives of war-raids, or their descendants; and after a few generations they become serfs; but nowadays few slaves can be captured. A group of the landholding «lords» are united in vassalage to some one of the several hereditary «princes» that exercise some sort of control of certain large districts, and are frequently at war with each other. The feudal lords replenish their wealth by raids on their neighbors, by payments from Chinese for the privilege of going into the Lolo country to obtain timber, minerals, furs, the eggs of the wax-insect, etc. The country abounds in coal, copper and precious minerals, but mining ceased with the expulsion of the Chinese since about 1906.

The Lolos, despite the fine personal features described, and a respectable body of laws, formalities and courtesies, are without much civilization. They have no roads or bridges or wheeled vehicles, and almost no industry or trade among themselves. Their best houses even are the rudest of plank-built huts, and contain no furniture except some chests and cupboards; in the centre is a stone fireplace, the smoke from which escapes where the rain comes in, for the roof is simply unmatched boards held in place by big stones. Around the lord's house are clustered the even worse huts of his servants, and the whole is usually enclosed by a defensive wall, for robber-raids are frequent. The villages are walled. Rice is cultivated in the valleys where irrigation is possible, and elsewhere oats, barley, buckwheat and potatoes. The low degree of social culture is a result of isolation and hardships, rather than of stupidity, for in old times the Lolos had the art of writing, which seems to have been general among them, using the equivalent of very ancient Chinese characters. Certain nobles and a class of learned men among them still preserve and copy ancient manuscripts of a genealogical and religious nature; and many such documents are sacredly guarded in Lolo communities in Yunnan, where carved inscriptions in the Lolo language may be found. A collection of these literary relics was taken to France by the D'Ollone expedition, and a French-Lolo dictionary has been compiled. French missionaries have reached the independent Lolos, and interested them in Western knowledge; and preparations are making, with the help of one of the most influential «princes,» to express their language in Roman letters, and to print books for these benighted but quick-witted people, to whose many sterling qualities every European who has become acquainted with them willingly testifies. A period of regeneration therefore seems to be at hand for the Lolo race. Consult Davies, R. H., 'Yunnan, the Link between India and the Yanktze' (London 1909); D'Ollone, Vicomte, 'In Forbidden China' (Eng. trans. by B. Miall, Boston 1913); Andrews, R. C. and Y. B., 'Camps and Trails in China' (New York 1918).

LOMAMI, lō-mä'mē, Kongo Free State, a navigable river of Central Africa which rises near Kazaidi (Msoa), and after flowing almost parallel with the upper course of the Kongo River enters the latter at Isangui several miles below Stanley Falls.

LOMAX, John Avery, American folklorist: b. Goodman, Miss., 23 Sept. 1870. In 1897 he was graduated at the University of Texas and subsequently studied at the universities of Harvard and Chicago. He was instructor and associate professor of English at the Agricultural and Mechanical College of Texas from 1903 to 1910 and became secretary of the University of Texas in 1910. He is well known as a lecturer on American folklore and folk-songs; is member of the Modern Language Association of America and was president of the American Folklore Society in 1912 and in 1913. He is one of the founders of the Texas Folklore Society. He has published 'Cowboy Songs' (1911); 'The Book of Texas,' with H. Y. Benedict (1916); 'Plantation Songs of the Negro' (1916).

LOMAX, Lunsford Lindsay, American soldier: b. Newport, R. I., 1835; d. 1913. His father was an army officer of a Virginia family. Young Lomax was graduated at West Point (1856) and assigned to a cavalry regiment. He served on the frontier until Virginia seceded when he resigned and entered the Confederate army as captain. He served as a staff officer under Joseph E. Johnston in 1861, and in the West under McCulloch and Van Dorn (1862). While with the Western armies he was engaged in the battles of Pea Ridge, Shiloh and Baton Rouge. From 1863 to 1865 Lomax held a cavalry command in Lee's army and took part in all the great battles. He reached the rank of major-general in 1864. When Lee surrendered, Lomax escaped to Johnston in North Carolina with whom he surrendered. After the war he engaged in farming in Carolina County, Va., until 1889, when he became president of the Virginia Polytechnic Institute. He was afterward engaged in compiling the official war records at Washington and served as a member of the Gettysburg Battlefield Park Commission.

LOMBARD, lŏm'bạrd, **Peter,** also known under his Latinized name, PETRUS LOMBARDUS, Italian theologian: b. Lugelogno, near Novara, Lombardy, about 1100; d. Paris, 20 July 1164. He was a scholar of Abélard, and traditionally the first doctor of the University of Paris. He then became a teacher of theology, and in 1159 bishop of Paris. In his 'Sententiarum Libri Quatuor,' which became the subject of almost countless commentaries, and until the Reformation had almost classical authority among theologians, he placed the opinions of the Fathers, particularly Augustine, in regard to doctrines under certain titles, and then stated the objections made to them and the answers given by Church authorities, but without offering any judgment of his own. The name of his work has given him the surname of Master of Sentences. Consult 'Life' by Protois (1881).

LOMBARD ARCHITECTURE. See ARCHITECTURE.

LOMBARD COLLEGE, a coeducational institution founded, in 1851, in Galesburg, Ill., under the auspices of the Universalists. In 1917 there were connected with the school 27 instructors and 234 students. The library contains about 8,000 volumes. It has a preparatory department and a classical department. The degree A.B. is conferred on those completing the classical course.

LOMBARD STREET, a short street in London, which received its name from having been the residence of the Lombards, the first bankers of modern Europe, who began to flourish in the 12th and 13th centuries, and whose usurious transactions caused their expulsion from the kingdom in the reign of Elizabeth. It is now chiefly occupied by bankers, and is a place of much importance in the London commercial world. It is the English equivalent of Wall street.

LOMBARDS, LONGOBARDI, or **LANGOBARDI,** a Germanic or Teutonic people who at the beginning of the Christian era were dwelling on the lower Elbe. They make little appearance in history till the 6th century, when, under their king, Albion, they entered Italy in April 568, and, with the help of Saxons and others, conquered the northern portion, which hence received the name of Lombardy. From 713 to 744 the Lombards had a powerful king in the person of Liutprant, who extended his sway, at least temporarily, over the whole of Italy. From that time the power of the Lombards gradually declined, and finally Charlemagne captured Pavia after a six months' siege, and put an end to the Lombard kingdom (773 or 774), the last monarch being Desiderius.

LOMBARDY, lŏm'bạr-dĭ, **Italy,** that part of upper Italy between the Alps and the Po, with Venice on the east and Piedmont on the west. It formed an ancient kingdom, now a northern compartimento embracing the eight provinces of Bergamo, Brescia, Como, Cremona, Mantua, Milan, Pavia and Sondrio, with an aggregate area of 9,299 square miles and a population in 1911 of 4,790,473. Lombardy took its name from the Longobardi or Lombards. (See LOMBARDS). Herding is a thriving industry on the mountains; on the lower slopes vines, fruit trees and silkworms are cultivated; on the plains rice and maize are among the principal crops. Linen and cotton are among the manufactures, also motor cars and accessories. After the fall of the Lombard kingdom (774) this territory remained attached to the empire of Charlemagne and his successors till 843, when an independent kingdom arose, though before its end (961) it had broken up into a number of independent duchies and civic republics. They successfully resisted the attempts of the Emperors Frederick I and II to curtail their liberties, and defeated them in battle. Freed from external danger, they quarreled among themselves, and the country was for many years more or less an object of contention between the king of France and the emperor. The last named having won, Lombardy passed through Charles V to Spain (1535) which held possession until 1713, when Austria acquired the duchies of Mantua and Milan. The provinces were then called Austrian Lombardy, a name which they retained till Napoleon formed in 1797 out of them and other districts the Cisalpine, afterward the Italian, Republic, and at last, in 1805, the kingdom of Italy. By the Peace of Paris, 1814, and the act of the Congress of Vienna, 1815, Austria received back its old Lombard possessions; but in consequence of the war of 1859 was compelled to cede them to Victor Emmanuel, king of Sardinia, by the Peace of Zürich, and in 1861 they became part of the new kingdom of Italy.

LOMBOK, Dutch East Indies, one of the Lesser Sunda Islands, east of Java, between Bali on the west and Sumbawa on the east. Area, 3,136 square miles. The island is mountainous and of volcanic origin. Between the two ranges which traverse the island, one of them rising to the height of 11,800 feet, there is a plain fertile in rice, cotton, maize, coffee and tobacco. The upper and former ruling class are Brahmans, and the mass of the people of Malay extraction are Mohammedans. The capital, Mataram, on the west coast, was bombarded in 1894 by a Dutch expedition, since when the island is administered by the Dutch resident on Baili, with which it is conjoined for administrative purposes. Pop. about 400,000.

LOMBROSO, lŏm-brō-zō, **Cesare,** Italian criminologist, the founder of the science of criminology: b. (of Jewish parents) Verona, 1836; d. Turin, 19 Oct. 1909. He developed early, and was writing on learned subjects before he was out of boyhood. He was educated at Paris, Padua, and in 1862 he was appointed professor of psychiatry at Pavia. In 1872 he made the important discovery that *pallagra,* a disease that affects the Italian peasantry, is caused by diseased maize. He became widely known through his investigations of the abnormal human being, and spent much time in minute measurements of criminal types. His theories encountered great opposition, and are not yet entirely accepted; but they formed in part the basis for the present criminal anthropology. He looked on genius as a form of degeneracy; and criminality as marking a reversion to an earlier type and as largely the product of nervous disease. He was the author of numerous works including 'The Criminal' (1887–95); 'The Man of Genius' (1890; Eng. trans., 1891); 'The Anarchists' (1895); 'The Causes of and Contest against Crime' (1902); 'After Death — What?' (Eng. trans. 1909), and 'The Female offender' (with Ferrero; Eng. trans., New York 1895). Consult the study by Kurella (1892); the biography by his daughter (Turin 1906); and Ferrero, T. L., 'Criminal Man according to the Classification of Cesare Lombroso' (New York 1911).

LOMÉNIE DE BRIENNE, lō'mą'nē'dē brē'ĕn, **Etienne Charles de,** French ecclesiastic and politician: b. Paris, 9 Oct. 1727; d. 16 Feb. 1794. He entered the Church, in order to facilitate his personal advancement. He became a doctor of theology in 1751 and in the following year became grand vicar to the archbishop of Rouen. In 1760 he was consecrated bishop of Condom and three years later was translated to the archbishopric of Toulouse. He was intimate with Morellet, Turgot and Voltaire. He became prominent in the general assembly of the clergy and took a deep interest in social questions. In 1770 he was elected to the Academy and in 1787 became president of the Assembly of Notables. In the same year he succeeded Calonne as head of the Council of Finances. He was involved in several disputes with the Parliament, and finally was obliged to promise to summon the States-General in return for the abolition of Parliament. In 1788 he became archbishop of Sens and on 29 August of that year he was forced out of office. He was made cardinal 15 Dec. 1788 and spent the following two years in Italy. After the outbreak of the Revolution he returned to France and subscribed to the civil constitution of the clergy. For this he was repudiated by the Pope. The leaders of the Revolution viewed his activity with suspicion in the light of his past political acts and had him arrested at Sens on 9 Nov. 1793. He died in prison either by poison or of an attack of apoplexy. Cardinal Loménie of Brienne published 'Oraison funèbre du Dauphin' (1766); 'Compte-rendu au roi' (1788); 'Le Conciliateur,' with Turgot (1754). Consult Perrin, J., 'Le Cardinal Loménie de Brienne épisodes de la Révolution' (Sens 1896).

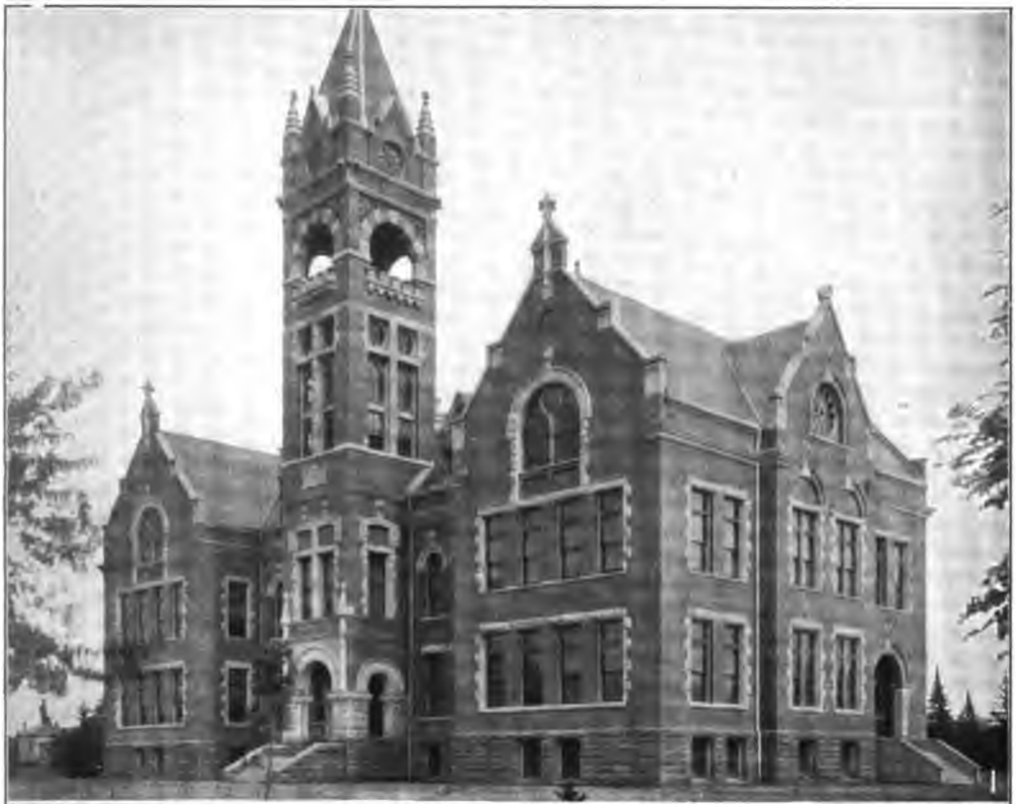
LOMOND, Loch, lŏk lō-mȯnd, Scotland, the largest and one of the most beautiful of Scottish lakes in the counties of Stirling and Dumbarton. Its length is about 24 miles; the breadth at the lower or southern end five miles, at the upper end less than half a mile. For 14 miles from the head the breadth does not exceed one and one-half miles. The lake is almost entirely surrounded with ranges of hills; and its surface is studded with numerous islands. The principal hills are on the eastern side, where a branch of the Grampians culminates in Ben Lomond, 3,192 feet high, on the very border of the lake. Through the glens intersecting the surrounding hills the drainage of the district flows into the lake by the Falloch, Endrick, Fruin, Luss and other streams; and the river Leven at the southwestern extremity conveys the overflow to the Clyde. The greatest depth is in the narrower part of the lake, where it reaches 623 feet. Railway steamboats ply on the loch.

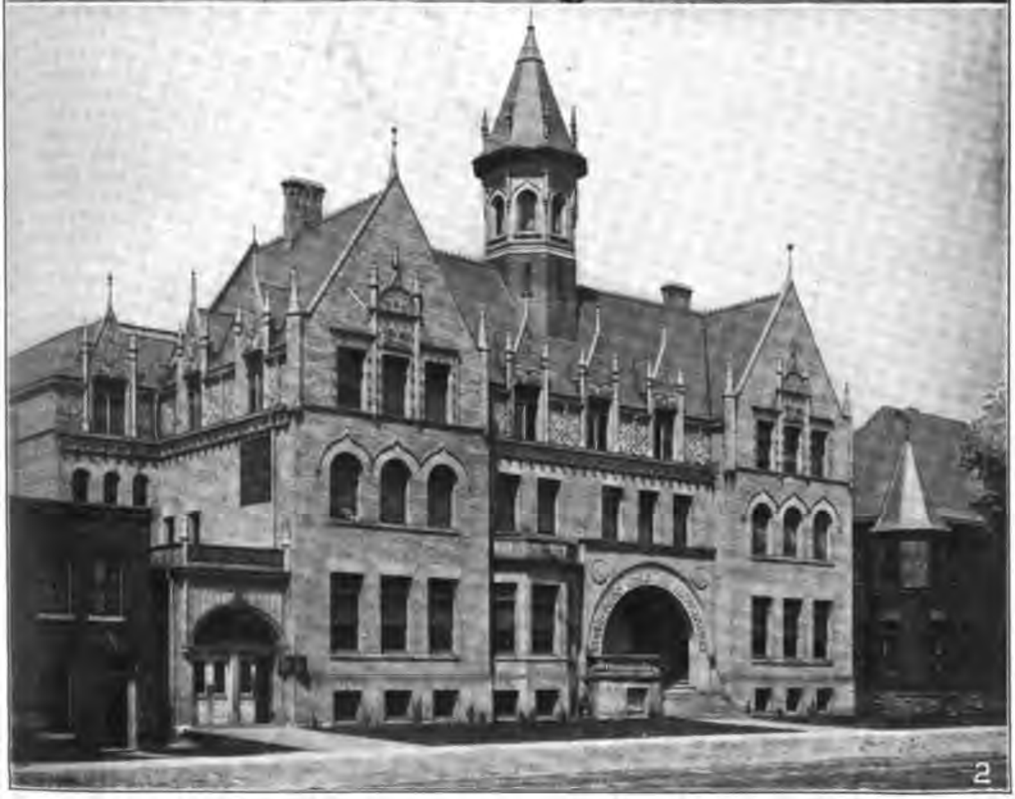
LOMONOSOV, lō-mō-nō'sŏf, **Mikhail Vasilievich,** Russian poet and man of science: b. Denisovka (now Lomonosov), near Archangel, 1711; d. 1765. His father was a fisherman in poor circumstances and the youth's schooling was confined to a few books which he almost committed to memory. At the age of 17 he decided to go to Moscow to obtain an education and in that city with the aid of friends secured admission to a school. There he lived in want but made rapid progress in his studies and in 1734 was sent to Saint Petersburg. In the capital he made great progress in physical science and was chosen one of the youths to be sent abroad to finish their education. At Marburg he studied metallurgy and subsequently spent two years at Freiberg. In 1739 he published his 'Ode on the Taking of Khotin from the Turks,' which attracted great attention. He also wrote dramas, epigrams, etc., in the style of the period. In Germany Lomonosov married a German girl and soon found himself unable to maintain his domestic establishment on the irregular remittances from his government. He left Germany secretly and in his native country soon rose to distinction. He was at first professor of chemistry in the University of Saint Petersburg of which he was later made rector, and was appointed Secretary of State in 1764. His Russian grammar was long the standard work in its field and did much to stamp the form of the new Russian after its break with Church Slavonic. Perhaps Lomonosov's greatest monument is the great University of Moscow, of which he was the founder and the early policy of which he planned. He was one of the most learned men in Europe. His Russian grammar is said "to have drawn out the plan, and his poetry to have built up the fabric of his native language." He is called "the father of Russian literature." Consult the edition of his works issued by the Imperial Academy of Sciences (4 vols., Saint Petersburg 1892–98); Pekarsky, 'History of the Academy of Sciences' (Vol. II, ib. 1873); the lives by P. Borzakovsky (Odessa 1911) and B. N. Menshutkin (Saint Petersburg 1911).

LOMZA, lōm'zhą, Poland, town on the Narew, 100 miles northeast of Warsaw. It contains an ancient church, a theatre, gymnasium and government buildings. It formerly had a large trade with Prussia and Lithuania; was well fortified; had two citadels, but was several times taken by Germans, Tartars and Cossacks. It fell to Prussia in 1795, but in 1807 came under the rule of Russia. In the Great War of 1914 a battle was fought here between the Germans and Russians, in which the latter were defeated and forced to fall back. In 1918 it became part of the newly erected Polish state. Pop. 28,000, mostly Poles and Jews.

LONDON, Jack, American author: b. San Francisco, 12 Jan. 1876; d. Glen Ellen, Cal., 22 Nov. 1916. He was the son of John London, a frontiersman, scout and trapper, who had come to San Francisco in 1873. His early life was spent on California ranches up to the age

LONDON, CANADA





1 Normal School **2 Young Men's Christian Association Building**

of nine years, when the family removed to Oakland, Cal. From his ninth year, with the exception of intermittent periods at school, his life was one of toil, which has been vividly presented to the readers of his work, for practically all of his novels and short stories have a background taken from his own life.

His experiences in youth as an oysterman and bayman, his long voyage on a sealing schooner along the coast north of the Russian side of the Behring Sea, his many short voyages, his year of following the life of a tramp bent on acquiring experience and investigating social and economic conditions, have all been brilliantly built into his many works of fiction. At 19 years London entered the University of California, but half way through his freshman year he had to quit for lack of money or means to support himself. He went to work in a laundry, writing in all his spare time. London gave up work in the laundry to go to the Klondike during the gold rush there in 1897. He was one of the few who made it in the winter of that year over Chilcoot Pass. After a year of unsuccessful gold seeking he fell a victim of the scurvy. Unable to get a homebound steamer, he and two camp mates embarked in an open boat for the Behring Sea. It was immediately upon his return to San Francisco that he began to turn out literature. More than once in his books London insisted that he gained his literary equipment through his hard life. His Alaskan experiences were reflected in his earlier works. He leaped into fame as one of the foremost young American authors with 'The Call of the Wild' (1903). In 1904 and 1905, after the series of Alaskan stories had given him great fame and founded the school of writers who for some years after placed their stories in an Arctic setting, London went to Korea as a war correspondent. After his return he settled down to produce fiction in amazing volume, interrupting this only for a number of picturesque cruises. In recent years he and Mrs. London had lived a large part of the time at Hawaii. London was the author of the following: 'The Son of the Wolf' (1900); 'The God of His Fathers' (1901); 'A Daughter of the Snows' (1902); 'The Children of the Frost' (1902); 'The Cruise of the Dazzler' (1902); 'The Faith of Men' (1904); 'The Sea Wolf' (1904); 'The Game' (1905); 'War of the Classes' (1905); 'Tales of the Fish Patrol' (1905); 'Moon Face' (1907); 'White Fang' (1907); 'Love of Life' (1907); 'Before Adam' (1907); 'Lost Face' (1909); 'Martin Eden' (1909); 'The Iron Heel' (1908); 'The Road' (1908); 'Revolution' (1910); 'Burning Daylight' (1910); 'Theft' (1907); 'When God Laughs' (1910); 'Adventure' (1911); 'The Cruise of the Snark' (1911); 'Smoke Bellew' (1912); 'Night-Born' (1912); 'The Abysmal Brute' (1913); 'The Valley of the Moon' (1913); 'Mutiny of the Elsinore' (1914); 'The People of the Abyss' (1903), his adventures in the East End of London; 'The Kempton-Wace Letters' (1903) and 'John Barleycorn, or Alcoholic Memoirs' (1913); 'The Strength of the Strong' (1914); 'The Scarlet Plague' (1915); 'The Star Rover' (1915); 'The Little Lady of the Big House' (1916); 'Jerry' (1916); 'The Turtles of Tasmar' (1916).

LONDON, Meyer, American lawyer and Socialist: b. Russia, 29 Dec. 1871. His early years were spent in southern Russia but in his 20th year desiring to obtain a higher education, then impossible in Russia for a man of Jewish race, and being under the surveillance of the secret police because of his known sympathy with the radical elements in Russia, he emigrated to the United States. He earned a precarious livelihood in New York as printer and cigarmaker for several years. At length he was engaged by the Educational Alliance and there was afforded his long-sought opportunity of educational advancement. He studied law and was admitted to the bar in 1898. Establishing his practice in New York's great East Side Mr. London soon became prominent as counsel for labor unions, many of which he organized and helped to build up. In 1910 he helped in the settlement of the cloakmakers' strike in New York by means of the industrial protocol. Two years later he was equally successful in bringing about a settlement between the garment workers and their employers. Meanwhile, Mr. London was very active on the East Side as a community worker and had become a prominent member of the Socialist party. He attended several of the national conventions of that party and in 1914 was appointed delegate to the International Socialist Congress at Vienna, which, however, was not held because of the outbreak of war that year. In November 1914, Mr. London was elected member of the 64th Congress from the 12th New York District, being the first member of his party in the East and the second in the country to be so honored. He was re-elected to the 65th Congress in 1916. Considerable criticism was directed toward his attitude to the many measures introduced in the House after the entry of the United States into the Great War. He voted against the declaration of war and against the selective-service act and many other measures for the active participation of the country in the war. In November 1918 Mr. London was for the third time the Socialist candidate for Congress from the 12th District, but his defeat was brought about by a coalition of the Democrats and Republicans, who placed a fusion candidate in the field against him, and by a united vote were enabled to overcome the strong Socialist vote in the district.

LONDON, Canada, city in the County of Middlesex, Ontario, at the junction of the north and south branches of the Thames River, midway between Niagara Falls and Windsor, about 23 miles north of Lake Erie, and on the Grand Trunk, the Canadian Pacific, the Michigan Central and the Père Marquette railroads. London was selected by Governor Simcoe in 1794 as the location of the future capital of Upper Canada, but this selection was set aside in favor of York (Toronto). The first clearings were made by the Talbot settlers here in 1818. The principal manufactures are stoves, furniture, car works, lumber products, chewing gum, cigars, clothing, agricultural implements, carriages, electrical machinery and supplies, shoes, iron rolling mills, flour mills, chemicals, breweries and cement products.

The principal institutions are the Western University, the Academy of the Sacred Heart, the Provincial Asylum for the Insane, Victoria and Saint Joseph's hospitals, two orphanages, Conservatory of Music and Harding Hall, a college for young ladies and a collegiate institute. London is the seat of Roman Catholic and Anglican bishoprics. Pop. 58,056.

LONDON, England, the largest city in the world, the capital of the United Kingdom of Great Britain and Ireland, and of the British Empire, situated on both banks of the Thames River, about 40 miles from its mouth, the latitude and longitude of Saint Paul's Cathedral being respectively 51° 30′ 48″ N. and 0° 5′ 48″ W. Modern London consists of the city of London as the nucleus, and the occupied surrounding parts of about 120 square miles taken from the counties of Middlesex, Surrey and Kent. In 1855 the Metropolis Management Act was passed, defining for sanitary purposes, outside the nucleate city of London with 675 acres, 85 parishes, the whole, including the city, covering an area of 75,379 acres, 31,422 acres being the county of Middlesex, 23,893 acres in Surrey and 20,064 acres in Kent. By the Local Government Act of 1888 this area was constituted the administrative county of London. In 1899, by the London Government Act of that year, the boundaries of the county were slightly altered, and the whole, with the exception of the city of London, was divided into 28 metropolitan boroughs, including the city of Westminster. The area of the administrative county is now 74,816 acres, including 31,652 acres formerly in Middlesex, 23,100 formerly in Surrey and 20,064 formerly in Kent. See LONDON COUNTY COUNCIL.

Table of the metropolitan boroughs, with their acreage and population in 1901 and 1911:

BOROUGHS	Area — acres	Pop., 1911	Pop., 1901
North of the Thames			
City of London	675	19,657	26,923
City of Westminster	2,502	160,261	183,011
Bethnal Green	759	128,183	129,680
Chelsea	660	66,385	73,842
Finsbury	586	87,923	101,463
Fulham	1,703	153,284	137,289
Hackney	3,287	222,533	219,272
Hammersmith	2,286	121,521	112,239
Hampstead	2,265	85,495	81,942
Holborn	405	49,357	59,405
Islington	3,091	327,403	334,991
Kensington	2,291	172,317	176,628
Paddington	1,356	142,551	143,976
Poplar	2,327	162,442	168,822
Saint Marylebone	1,473	118,160	133,301
Saint Pancras	2,694	218,387	235,317
Shoreditch	658	111,390	118,637
Stepney	1,766	279,804	298,600
Stoke Newington	863	50,659	51,247
South of the Thames			
Battersea	2,160	167,743	168,907
Bermondsey	1,500	125,903	130,760
Camberwell	4,480	261,328	259,339
Deptford	1,563	109,496	110,398
Greenwich	3,852	95,968	95,770
Lambeth	4,080	298,058	301,895
Lewisham	7,014	160,834	127,495
Southwark	1,131	191,907	206,180
Wandsworth	9,107	311,360	232,034
Woolwich	8,277	121,376	117,178
Total	74,816	4,521,685	4,536,541

The name London is therefore legally and properly applicable to the entire area within the county boundaries. But outside the county limits the urban aggregation extends, with numerous large and connected towns, to 15 miles around Charing Cross. These are embraced in the boundaries of the metropolitan and city police districts and constitute Greater London, bringing the total area to 443,424 acres with a population (1901) 6,581,402, (1911) 7,251,358; estimate of 1914, 7,419,704.

Climate.— London is one of the healthiest of the large cities of Europe. The death rate per 1,000 living in 1841–50 was 24.8; 1851–60, 23.7; 1861–70, 24.4; 1871–80, 22.5; 1881–90, 20.5; 1891–1900, 19.1. The death rate for 1914 was 15 per 1,000, and the birth rate 24.8 per 1,000. The mean annual temperature is about 50° and the general range of the thermometer is from 20° to 81°; the highest and lowest markings being, for the most part, in August and January respectively. The prevailing wind is the southwest, and there are few places in the kingdom where less rain falls. In the beginning of winter London is occasionally enveloped in fogs, which are especially dense in the lower parts, and greatly aggravated by the perpetual pall of smoke-laden air overhanging the metropolis. This pall is occasioned by the general domestic and industrial use of bituminous coal. Even when this smoke-cloud does not take the unpleasant form of fogs it keeps the sunshine away to quite a considerable extent, in winter robbing London of fully half the sunshine it ought to enjoy, and giving to the metropolis that general gloom and begrimed aspect of buildings which are so depressing to visitors.

General Aspect, River, Bridges, Main Thoroughfares, etc.— London stands on alluvial deposits consisting of beds of clay and gravel, below which is the hard clay stratum known to geologists by the name of the "London clay," in the middle of the great chalk basin extending from Berkshire to the east coast. On the north bank of the Thames, where the principal part of London stands, the site rises gradually at the rate of 36 feet per mile, while on the opposite bank the houses cover a nearly uniform and extensive flat, lying in some places several feet below the highest tides. Within the limits of London the Thames varies considerably in width. At Putney it is 550 feet, at Battersea 960, at Vauxhall 630, at Westminster 275 feet, at Waterloo 1,140 feet, while at Blackfriars it narrows down to 830 feet. At London Bridge, it is 800 feet wide, and at Woolwich 1,470 feet wide. The bridge farthest down the river is Tower Bridge, just below the Tower of London — a bascule bridge, which allows the passage of large vessels. London Bridge connects the city at King William street with Southwark at the junction of Wellington street and Tooley street. About 500 yards further up the river stands Southwark Bridge, connecting the city and Southwark. About half a mile farther west Blackfriars Bridge, connecting the city at Bridge street with Southwark at Blackfriars road, was widened in 1908. Waterloo Bridge, nearly half a mile above the former, is a granite structure of 9 elliptical spans, and is 1,240 feet long between the abutments. It is perfectly level, and connects the Strand with the Waterloo road. Westminster Bridge crosses the river at the north end of the Houses of Parliament from Westminster to

Lambeth. Further up the river Westminster and Lambeth are again connected by Lambeth and Vauxhall bridges. The Chelsea Suspension bridge connects Chelsea and Pimlico on the north side with Battersea to the west of Battersea Park; and the Battersea Bridge unites Chelsea and Battersea a littler further west. Putney Bridge, a magnificent structure of granite, connects Fulham and Putney; and Hammersmith Bridge, the last in London, connects Hammersmith with Barnes. There are also six railway bridges across the Thames. One of them, at Charing Cross, displaced the old Hungerford Suspension Bridge, but is provided with a footway on one side. The two railway bridges at Pimlico, which look like one, belong to the London, Brighton and South Coast Railway Company and the London, Chatham and Dover. The latter company owns a bridge close to Blackfriars Bridge. The modern bridge at Vauxhall is said to be as notable a combination of art and utility as the famous Alexander III bridge in Paris. The once famous Thames tunnel, two miles below London Bridge, opened in 1843 as a roadway under the river, now serves as a railway tunnel. A subway under the river, lined with iron hoops, connects Tower Hill and Tooley street, Southwark; and there is a great tunnel for foot-passengers and vehicles between Blackwell and East Greenwich and one for foot-passengers only between the Isle of Dogs and Greenwich. A tunnel for both vehicular and pedestrian traffic between Shadwell and Rotherhithe was opened in 1908. Three underground electric railways pass under the river. There is a free steamboat ferry between North and South Woolwich.

Since the passing of the Metropolis Management Act of 1855 great changes have been made in the condition of London. The gigantic operations connected with the sewerage of London and the embankment of the Thames, from Blackfriars to Chelsea on the north side, and from Westminster Bridge to Vauxhall on the south, have produced great changes, while important lines of streets have opened up districts formerly almost inaccessible. These operations have also absorbed the former little rivers and rills, leaving only a corner, an alley or a street — for example, Fleet street — with their name for a monument. In all the districts of London, and particularly in the city and west end, there has been great improvement in the quality of architectural decoration and in public buildings, and stone has to a considerable extent replaced brick and plaster, though not so far as to change the aspect of some localities. Though some of the leading streets are wide, others are narrow and irregular. The decorative character of the streets about Lombard street, and the Mansion House in the city, has been fostered by the growth of numerous banking and insurance companies, while the new office and store buildings in various quarters, especially the one opposite Saint Mary-le-Strand, the hotels and apartment-houses on the American steel structure plan, have added an entirely new style of brick architecture.

«The City» — the historic centre of London — is bounded south by the Thames; it extends north to Charterhouse Square, east to Middlesex street and west to the New Law Courts. Till 1878 this last boundary was marked by Temple Bar, an old gateway crossing Fleet street near the Temple; but in that year this structure was removed, and a memorial was erected on the site. The portion of the city inside the area of the former mediæval walls is known as «London within the walls»; and all the wards are bounded by the site of the old walls; the portion outside extends irregularly all around and is known as «London without the walls.»

Of the streets that run through modern London the most important from west to east is that which enters from Kew into Hammersmith, and passing through Kensington forms the finest of all the approaches to London. It stretches on through Brompton, Knightsbridge and Piccadilly, past fashionable Belgravia, with Kensington Gardens, Hyde Park and Paddington on the north, and with Apsley House and numerous other palatial edifices facing the Green Park, which constitutes its south boundary for about half the length of Piccadilly. This line is broken at the east end of Piccadilly, but passes by Regent street (or by the Haymarket) and Trafalgar square into the Strand, which continues it farther east and much nearer the river, and it stretches on past the Temple, along Fleet street, Ludgate Hill, Saint Paul's Churchyard, where it runs into Cannon street, leading to the Tower on one side, and on the other into Cheapside, Poultry, Lombard street, Fenchurch street, Aldgate and by Whitechapel road and Mile-end road through the congested poorer districts to the county boundary at Bow. The next great artery between the west and east extends along the Uxbridge road from Acton, entering the county boundary at Shepherd's Bush and passing through Notting Hill, along Oxford street, through Holborn and Newgate street, where it joins the more south line above described, at the west end of Cheapside. Farther north is a third line, extending from near Kensington Gardens, through Oxford and Cambridge Terrace along the Marylebone, Euston, Pentonville road, to Islington, and thence by the city road to Finsbury square. Among the leading thoroughfares running north and south the extreme west is Edgeware road, which enters the county at Kilburn, terminating at its south extremity in Oxford street, from which it runs northwest, but communicating through Park lane with Piccadilly, a little to the west of which, from Hyde Park Corner place, Grosvenor place leads down to Buckingham Palace road, from which Vauxhall road forms a connecting line with the river. Park lane and Grosvenor place on this line contain many of the most select residences of the aristocracy. East of the Edgeware road, Regent street with Portland place, Tottenham Court road with Charing Cross road, and other connecting lines leading to Westminster, Pimlico and Chelsea, Gray's Inn road, and the line of Chancery lane, Farringdon street, etc., leading to Fleet street and Blackfriars Bridge, form some of the most important communications in this direction. Piccadilly and Pall Mall, running east and west, Bond street, Regent street and Saint James' street, north and south, are among the most fashionable streets in the West End, each with its own distinctive character. Bond street contains the shops most patronized by the aristocracy; Regent street, according to some tastes the handsomest street in London, is the fashionable promenade and has some of the finest shops. It unites by Portland place in the north with Regent's Park and Primrose Hill Park, and intersects Oxford street and Piccadilly, and reaches south to Waterloo place, by which it communicates with Saint James' Park. The greatest and most picturesque thoroughfare in London, not of an exclusively mercantile character, is the line of the Strand and Fleet street. By the clearing away of congested streets, and the construction of Kingsway and Aldwich, the largest and most important improvement has been carried out since the construction of Regent street in 1820, and a connection given between North and South London at that part which needs it most.

The Thames Embankments belong to the modern features of London. The Victoria Embankment on the north side consists of a wide roadway, with a granite retaining wall, surmounted by a parapet broken by pedestals for lamps. There are well-contrived landing-stages and recesses, these features of the Embankment being rendered highly ornamental by balustrades, pedestals for sculpture, etc. From the Temple to Charing Cross portions of land reclaimed from the Thames have been laid out in public gardens. The Chelsea Embankment extends from the Albert Suspension Bridge eastward past Chelsea Hospital. From the fine building of Saint Thomas' Hospital next Westminster Bridge, on the south side of the river, extends the Albert Embankment, continuous with the old quay at Lambeth. A very valuable improvement in the city was the Holborn Valley Viaduct, extending from Newgate street to the end of Hatton Garden. Broad roads also lead to the Central Meat Market, and to the lower level of Farringdon street, which is crossed by the viaduct obliquely, with three Gothic arches supported on 12 hexagonal columns of polished red granite. The estimated length of streets in London is considerably over 2,000 miles.

Public Buildings in the City.— A number of the most important buildings are situated within the ancient city. The nucleus of the whole is formed by the Bank of England, the Royal Exchange and the Mansion House, which all face toward an open area, the centre of bustle and business, near the middle of the city, adorned with the handsome offices of several assurance companies. The Bank of England, in Threadneedle street, was built in 1732–34 and now forms a low flat, insulated, irregular parallelogram covering four acres of ground. The Royal Exchange is an extensive and ornate building, having a portico surmounted by a pediment enriched by sculpture. It surrounds an open interior quadrangle, in the centre of which is a marble statue of Queen Victoria. In this court, which is surrounded by covered arcades, the meetings of the merchants on Change are held. An equestrian statue by Chantrey of the Duke of Wellington occupies the area in front of the building. The Royal Exchange, originally founded by Sir Thomas Gresham in 1566, was burned down in 1666, rebuilt, and again burned down in 1838, the present edifice being erected on its site. The exchanges for special purposes are: The Stock Exchange in Capel court; the Coal Exchange, Lower Thames street, a sumptuous though rather incongruous building, the great hall of which is circular, 60 feet in diameter, and 74 feet to the apex of the glazed dome; the Corn Exchange, in Mark lane, opened in 1747, enlarged and partly rebuilt in 1827, and again almost entirely rebuilt. The Mansion House, the official residence of the lord-mayor, was built in 1739–53. The Guildhall, at the north end of King street, Cheapside, is where the principal business of the corporation of the city of London is conducted. The civic banquets are given here. A splendid new council chamber was completed in 1885. The hall itself is now covered with a decorative open timber roof of the Perpendicular Gothic style; the old front has been replaced by a new Gothic front. The hall is capable of seating 3,000 persons, and contains some monuments of ordinary sculpture; and at the west end, raised on pedestals, are colossal figures of Gog and Magog. In 1872 a handsome suite of rooms was added to the Guildhall for the Corporation Library and Museum. Of late years some of the city companies have remodeled or rebuilt their halls. Of these the Clothworkers' Company have produced the most elaborate street façade, but its confined situation in Mincing lane does not permit it to be seen to advantage. The Goldsmiths' Hall behind the post office; the Fishmongers' Hall near London Bridge; and the Ironmongers' Hall, in Fenchurch street, are the principal structures. In the city many old and familiar landmarks have been removed. The once famous East India House in Leadenhall street, and the Excise Office in Broad street, have been replaced by immense piles of offices; Doctors' Commons was cleared away for the new street to the Mansion House; Sir C. Wren's College of Physicians is supplanted by meaner buildings; the site of the Steel-yard, memorable in the history of old London, is absorbed by the city terminus of the South Eastern Railway; old churches have been leveled, and old inns, hostelries and streets, replete with great historic and literary associations, have disappeared; while outside the city a whole region full of good and bad memories was cleared way for the new Law Courts; the Statepaper Office is displaced by the Foreign Office; Tattersall's is crossed by streets; chambers occupy the ground of the Old Thatched House; and a gymnasium has supplanted the British Institution.

The Tower.— This celebrated fortress, which formed the dominating feature of Norman London, stands on the north bank of the Thames, immediately adjoining the boundary of the city. Besides its use as a fortress the Tower was the temporary residence of several kings and queens of England, but is now only used as a storage for armor and as headquarters for certain military matters. It occupies an area of 12 acres, enclosed within a wall surrounded by a ditch, now dry, and laid out as a garden. On the south side is an archway called the "Traitors' Gate," through which state prisoners were brought from the river. The whole region of the Tower abounds with reminiscences of English history, conjured up by such names as Raleigh, Algernon Sidney, Anne Boleyn, Catherine Howard, etc. The most ancient part is the keep, now known as the White Tower, which was erected about 1078 for William the Conqueror by Fundolph, bishop of Rochester. It stands near the centre of the quadrangle, around which are placed several other towers, each having its distinctive name. The Tower contains the Wellington Barracks, erected on the site of the grand storehouse, burned down in 1841; the jewel room, a modern edifice, in which are preserved the regalia of Great Britain; the horse armory, Queen Elizabeth's armory and the church of Saint Peter-ad-Vincula.

Church Buildings.— Saint Paul's Cathedral stands on the summit of Ludgate Hill, on a site which was formerly used for pagan worship, and has been occupied by a church from early Saxon times. Old Saint Paul's, a vast Gothic building, was destroyed by the great fire of 1666 and only a few columns of the chapter house now remain to view. The present church, on the same site, the greatest and most conspicuous architectural ornament of London, planned and carried out by Sir Christopher Wren, was begun in 1675 and completed in 1710. It is 510 feet in length from east to west, while the transept is 250 feet long, exclusive of the semicircular portico at each end; the breadth of the west front is 180 feet and the height of the walls 110 feet. The building is crowned with an immense dome, surmounted by a lantern with ball and cross, the height of the latter being 404 feet from the ground. It is built of Portland stone and cost £747,954, which was paid by levying a tax on coal. The interior has been decorated at great cost by voluntary means, according to the original intentions of Wren. Among the monuments it contains are those of Wellington, Nelson, Sir Ralph Abercromby, Sir John Moore, Dr. Johnson, Howard, Sir Joshua Reynolds and eminent men of more modern times. Near together, under the centre of the dome, lie interred Lord Nelson and the Duke of Wellington. Westminster Abbey, one of the finest specimens of the Pointed style in Great Britain, dates from the reign of Henry III and Edward I, when it was erected on the site of the Saxon minster founded by Sebert. The beautiful chapel at the east end was added by Henry VII, and at the beginning of the 18th century the upper parts of the two towers at the west end were erected from designs of Sir Christopher Wren. It is 360 feet long and 195 feet wide within the walls. Here kings and queens have been crowned, from Edward the Confessor to George V, and here many of them are buried, some with and others without monuments. In the south transept are the tombs and honorary monuments of great poets, from Chaucer down to Tennyson, whence it is called "Poets' Corner," and in other parts are numerous sculptured monuments to statesmen, warriors, philosophers, divines, patriots and eminent individuals generally, many of whom are interred within its walls. Of other sacred edifices in London the most remarkable are Saint Bartholomew's in West Smithfield, which consists of the chancel and lady-chapel only of the original church and contains some beautiful specimens of Norman, Early English and later styles of architecture; Saint Saviour's in Southwark, now a cathedral, boasts of the best Early English architecture in London in its choir and lady-chapel, the principal portions of the old church which remain; Saint Giles', Cripplegate, a beautiful pre-Reformation church; Saint Stephen's, Walbrook, the interior of which is extremely fine and generally regarded as one of Wren's best works; and the Temple Church, which is one of the very few round churches now remaining in England, and combines transition Norman architecture with Early English, the latter in the choir, which was founded in 1240. Besides these there are very few of the older churches left, among the most interesting of which is Bow Church. Of the remainder, Wren's churches are very beautiful, and perhaps Saint Bride's in Fleet street and Saint Martin's-in-the-Fields may also be specified. During the Georgian period hideous specimens of architecture were erected, and these still predominate. Among Roman Catholic churches in London are Saint George's Cathedral, in Southwark, finished in 1848, and the magnificent new cathedral of Byzantine architecture at Westminster, with an imposing campanile 300 feet high. The largest arch over any known church doorway admits 10,000 worshippers to ample accommodation under a central dome 120 feet high. The plan dispenses with stained-glass windows — a wise arrangement in dark London. Twenty-nine marble columns support aisles, galleries and arches of transepts, with bases of Norwegian granite and capitals of white Carrara elaborately carved. Many of the Non-Conformist churches are handsome structures. Among the finest of them are the City Temple on the Viaduct, opened in 1874; Christ-church in Westminster Bridge road; the Apostolic (or Irvingite) Church in Gordon square; and the Tabernacle, Newington Butts; while the site of the former Royal Aquarium at Westminster is now occupied by a mammoth connectional building, built by the Wesleyan Methodists.

The Houses of Parliament.—These consist of the House of Peers and the House of Commons, with the connected apartments and offices, the whole practically forming one structure. It is a highly decorated structure in the Tudor Gothic style, after designs by Sir Charles Barry. It stands on the left bank of the Thames, between the river and Westminster Abbey, and extends over an area of about eight acres. The façade which overlooks the river is 900 feet in length. The walls are of brick, faced externally with magnesian limestone, and the whole edifice is separated from the river by a terrace of Aberdeen granite. It is paneled with rich tracery, and profusely decorated with statues and shields of arms of the kings and queens of England from the Conquest to the present time. In the southwest angle is the Victoria Tower, supported on four pointed arches 60 feet in height; it is 75 feet square and 340 feet in height. There is also a tower in the centre, 300 feet high by 60 feet, surmounted by a lantern; and the clock tower, at the north end of the edifice, with its richly decorated spire, rises 320 feet. The House of Peers is an apartment 97 feet long, 54 feet wide and 45 feet high; magnificently decorated throughout with carved oak paneling, a profusion of gilding, paintings in fresco and richly stained glass windows. The House of Commons is a somewhat smaller apartment, fitted up in a much plainer style. Paintings in fresco and the water-glass medium and statues of great statesmen have been added to the internal decorations; and a statue of the architect has been placed on the staircase leading up to the committee rooms. Westminster Hall, the most magnificent hall in the kingdom, 290 feet long, was built by William Rufus and improved by Richard II. The hall is not now used except as a members' entrance to the House of Commons.

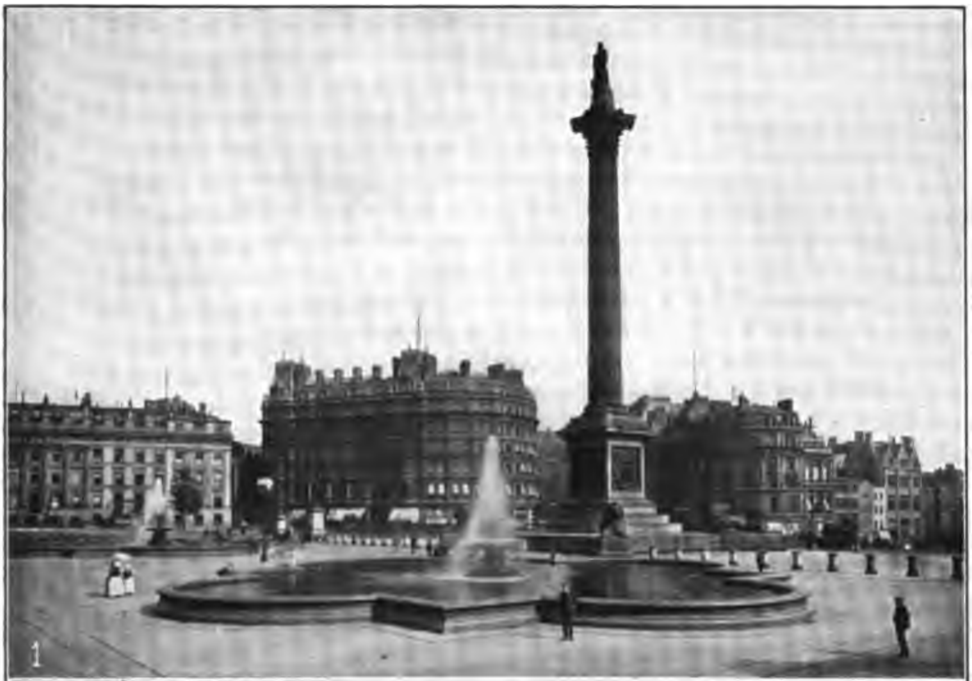
Palaces.— Saint James', erected by Henry VIII, from a design by Holbein, at the foot of Saint James' street, is an irregular and picturesque brick building. It is well adapted internally for royal levees and drawing-rooms, which are held here during the fashionable season. Buckingham Palace, facing the west end of Saint James' Park, was built by George IV, and consists, since the erection of the east front, of a quadrangular range of buildings. In the gallery, which is 160 feet long, are some good pictures. The king resides here occasionally in the spring and summer. Whitehall — the Banqueting House — designed by Inigo Jones in the Paladian style, is the only remnant of the ancient palace of Whitehall; the ceiling, painted by Rubens, is the most extensive work of that artist existing in the country. Kensington Palace, in Kensington Gardens, is a brick building of the Jacobean period, and was thrown open to the public by Queen Victoria shortly before her death. It was the birthplace of her majesty. Lambeth Palace on the Surrey side of the river, opposite the Houses of Parliament, has been for many centuries the residence of the archbishops of Canterbury. It is a brick edifice, and comprises a great variety of styles in architecture, from Early English downward, and contains a magnificent library. Fulham Palace, the residence of the bishops of London, is a building of no architectural pretension. It is pleasantly situated on the Thames, and at one time had extensive and well-timbered grounds. Greenwich Palace, once the home of the Tudor and Stuart sovereigns, is a stone building of considerable beauty, now used as a training school for the navy. Eltham Palace, once a residence of Henry VIII, is now a picturesque and well-preserved ruin.

Government Offices.— These are mostly situated in and near Whitehall. The Treasury, Home Office and Education Department occupy one range of buildings, which have been improved by a uniform and handsome façade. The India Office and the Local Government Board face Saint James' Park. The Horse Guards, which are somewhat nearer Charing Cross, have little to admire in their external appearance, but opposite, and next to the banquet hall of the old Whitehall Palace, from the window of which Charles I stepped to his execution, rises the New War Office, and farther on the New Admiralty Office. An extensive pile of government offices, for the Foreign Office and the Colonial Office, has been erected in Downing street. The style is Italian, and the building exhibits a large amount of decorative detail, part of it in red and other colored marbles and granites. Some of the public offices are in Somerset House, once a royal palace of Charles II. It has a spacious and handsome quadrangle, finished in 1782, from designs by Sir W. Chambers; its north façade, 200 feet in length, faces the Strand; and its south front, 800 feet long, overlooks the river. The post office, near Saint Paul's, is a spacious and handsome building. It is 390 feet long, 130 feet wide and 64 feet high. Its façade, which is toward Saint Martin's-le-Grand, has three Ionic porticoes. A supplemental building for telegraph and other business occupies the opposite side of Saint Martin's-le-Grand. The mint, a stone building of the ordinary Georgian architecture, finished in 1810, stands on Tower Hill, and occupies about 10,000 square yards. The royal arsenal and dockyard for military stores is at Woolwich.

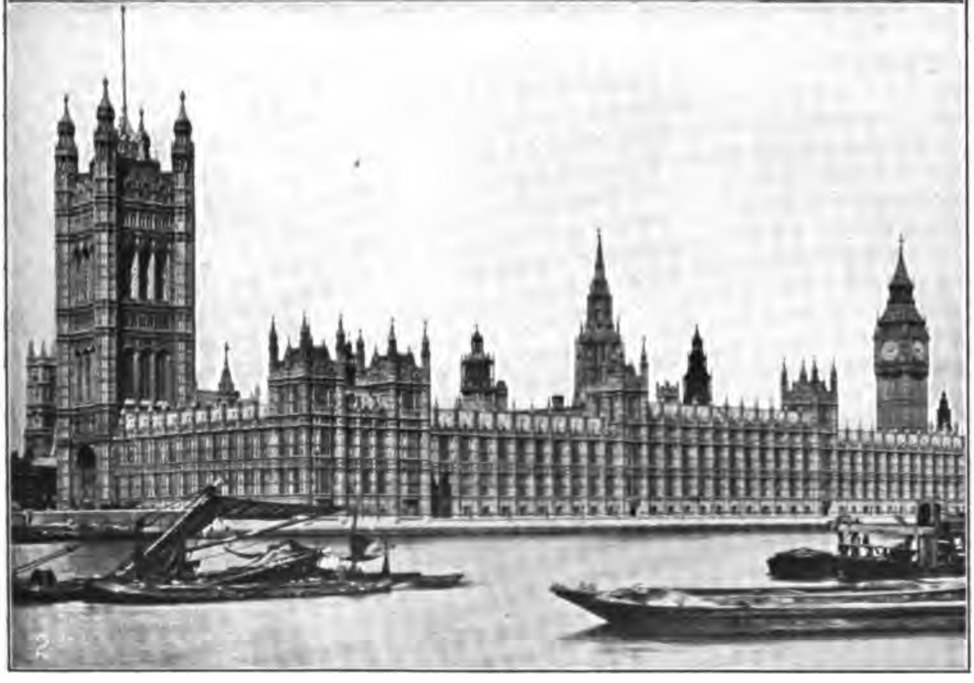
Courts of Law.— London is the seat of the supreme courts of the kingdom. Several of these were long accommodated at Westminster Hall, but in 1883 were removed to the New Law Courts at the junction of the Strand and Fleet street. This great building occupies an area of nearly four acres. It is of a somewhat heavy mediæval character, a large western tower being its chief feature. The Old Bailey, adjoining the famous Newgate Prison, has, with the latter, been demolished to make way for the palatial Sessions House of the city of London. It is the central criminal court for the trial of prisoners who have committed serious offenses in the metropolitan district. One or more of the judges of the law courts sit here also in the old court, while the new court is presided over by the recorder and common sergeant of the city of London. There are numerous County Courts within London for the trial of small debt cases. Besides the above there are also the Clerkenwell Session House; the city police courts, which are held at the Mansion House and Guildhall, and are presided over by the lord-mayor and one of the aldermen; and numerous police courts, each of which is presided over by a barrister of at least seven years' standing. The Inns of Court, as they are called, are four, the Inner Temple, Middle Temple, Lincoln's Inn and Gray's Inn. Every law student, before he can be called to the bar, has to be entered as a member of one of these inns, and to dine a certain number of times in the common hall. The Inner and Middle Temple are close to Temple Bar, between Fleet street and the river. The roof of Middle Temple Hall, built in 1572, is considered the best specimen of Elizabethan architecture in London. Lincoln's Inn is situated between Chancery lane and the extensive square called Lincoln's Inn Fields, now open as a public garden. A handsome hall and library in the Tudor style, from the designs of Hardwick, have been erected in the gardens. Gray's Inn stands on the north side of Holborn. The other «Inns,» Staple Inn, New Inn, Sergeant's Inn, are now in private hands and not connected with the law.

Clubs.— Many of these establishments, having most elaborate and ornate buildings, are among the principal architectural features of West London. They are situated chiefly in and near Pall Mall and vie with each other in elegance and luxury. The principal are the Athenæum, possessed of a fine library, and having a great many artists and men of science and letters among its members; the Army and Navy, the United Service, the Guards' and the Junior United Service; the Carlton, the great Tory Club, standing side by side with the Reform Club in Pall Mall, the former number-

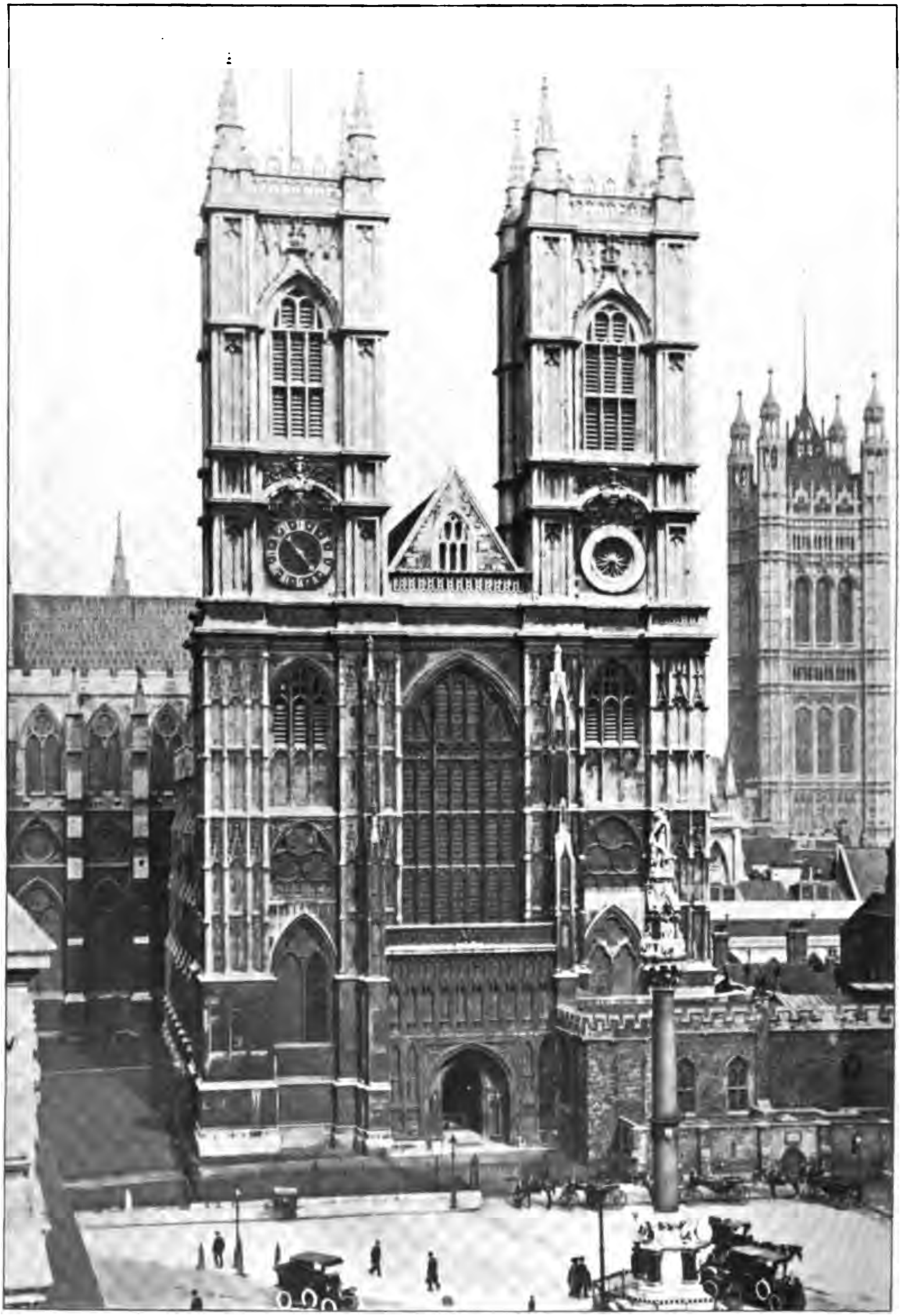
LONDON



1 Trafalgar Square



2 Houses of Parliament



WESTMINSTER ABBEY

ing 2,000 and the latter 1,450 members; the Junior Carlton; the Oriental; the Travelers'; Brooks', one of the oldest of the clubs; White's, a still older club, much frequented by the Conservative nobility; the Conservative; the Devonshire; the Oxford and Cambridge; the Garrick, frequented by lovers of the drama; the Royal Automobile, and four political clubs, which have the largest numbers of members, the Constitutional having 6,500, the National Liberal 5,000, the Junior Conservative 2,500, and the Junior Constitutional 5,000.

Hotels.— The Grand Hotel, Trafalgar square, occupying part of the site of old Northumberland House; the Victoria Hotel and Hotel Metropole in Northumberland avenue; the Hotel Cecil in the Strand; the Savoy Hotel on the Embankment; the Carlton Hotel at the corner of the Haymarket; the Russell Hotel, occupying the greater part of the east side of Russell square, recently built; the Piccadilly, occupying the site of Saint James' Hall; and De Keyser's immense hotel at Blackfriars, are the most important and attractive. There are large hotels at Charing Cross and Cannon street in connection with the South Eastern Railway, at Saint Pancras in connection with the Midland Railway, the last named being the largest and one of the handsomest in London; and at Marylebone in connection with the Great Central Railway. Also associated with railways are the Great Western Hotel at Paddington; the Great Northern Hotel in King's Cross; the Grosvenor Hotel at Pimlico. Other large hotels are the Langham Hotel, Portland place; the Westminster Palace Hotel in Victoria street; the Salisbury Hotel, in Salisbury square, Fleet street; the First Avenue near Gray's Inn; and the famous Ship Hotel at Greenwich.

Theatres, Public Halls, etc.— The principal theatres are Covent Garden (the Royal Opera House), opened in 1858; His Majesty's, the historic Drury Lane, the Haymarket, the Strand, the Adelphi, the Surrey, the Gaiety, the Vaudeville, Saint James', the Savoy, the Avenue, the Comedy, Criterion, Terry's, the Lyric, the Garrick, the Shaftesbury, the Duke of York, the Prince of Wales, Wyndham's, the Court, Daly's, the Kingsway and the London Opera House. There are also many new erections, whose names are not so familiar as those just named. Local theatres have been built in many of the outlying parts of London. Saint James' Hall, remarkable almost entirely for its interior and chiefly devoted to musical entertainments of a high class, has recently been demolished. The Queen's Hall in Portland place, and the Albert Hall at Kensington, are devoted to high-class music. Hanover Square Rooms were once famous as concert rooms. The Freemasons' Hall in Great Queen street is well known, and Olympia, at West Kensington, is a large and imposing hall in an extensive area. The Congregational Memorial Hall, and the Agricultural Hall, Islington, the largest covered area in London, are also important buildings of this kind. The Empire and the Alhambra in Leicester square and the Hippodrome in Charing Cross road are the chief of numerous music halls in London.

Markets.— These are numerous, but have generally little to attract either in external beauty or in internal arrangement. The principal ones are Billingsgate for fish; the Borough Market, Southwark, and the famous Covent Garden for vegetables, fruit, flowers and plants; Leadenhall for poultry, game, etc.; Deptford for foreign cattle; Smithfield for fresh meat, poultry and fish; the Islington Cattle Market, in the Caledonian road. The Spitalfields Market and the Woolwich Market, for vegetable products, are included in the public markets. But London is inadequately provided. The city corporation owns all the largest markets, and exercises charter rights to prevent others being erected. The result is that all retail markets are in the hands of costermongers.

Museums, Galleries, Libraries.— The British Museum (q.v.), founded in 1753, in Great Russell street, is a spacious and imposing edifice, with a classical façade and sculpture in the pediment, built between 1823 and 1857. It contains an immense collection of books, manuscripts, engravings, drawings, sculptures, coins, minerals, stuffed animals, fossils, preserved plants, etc., and a magnificent collection of ethnographical objects, Egyptian, Assyrian, Etruscan, Greek and other antiquities. An extensive building (about 650 feet long) has been erected in the South Kensington quarter for the accommodation of the natural history collections. The museum of the Royal College of Surgeons, on the south side of Lincoln's Inn Fields, a rather handsome building, contains a magnificent collection of human skulls from all parts of the world, and many curious surgical preparations. The Soane Museum, on the north side of Lincoln's Inn Fields, possesses many valuable objects, consisting of books, paintings, prints, manuscripts, drawings, maps, models, plans, etc. The Dulwich College Gallery contains many interesting pictures left by Alleyne, a contemporary actor of Shakespeare's age. The great South Kensington or Victoria and Albert Museum contains most valuable collections, carefully arranged for purposes of instruction, in connection with which are the schools and headquarters of the Department of Science and Art. The London Museum has, since 1914, through the munificence of Sir William Lever, been accommodated at Lancaster (formerly called Stafford) House, which he bought and presented to the nation. Museums have also been established at Bethnal Green and in South and North London, and Hertford House, acquired in 1900, with its priceless art treasures, the gift of Sir Richard Wallace, and the Horniman Museum at Forest Hill, the gift of the late Mr. F. J. Horniman, have been added to the London museums. The chief picture gallery in London is the National Gallery, on the north side of Trafalgar square. It contains upwards of 1,600 paintings, acquired partly from donations, partly by purchase. The National Portrait Gallery is a collection of over 1,600 portraits, busts and medallions, brought together since 1858. For this collection a new building beside the National Gallery has been provided by private munificence; and the Tate Gallery of British Art, on the Thames Embankment, has been similarly acquired. The Royal Albert Hall of Arts and Sciences, a memorial to the prince consort, is a huge building between the Horticultural Gardens and Kensington road. It was erected for the purposes of science and art, musical performances, exhibitions, etc. It is chiefly used for concerts and is capable of accommodating an audience of 8,000, while the orchestra itself accommodates 1,000 performers. The building also contains a picture gallery. In Hyde Park, immediately opposite this building, is the Albert Memorial. The north wing of Burlington House, Piccadilly, has been granted to the Royal Academy and a suite of rooms built in the rear of it for exhibitions. The east and west wings of Burlington House are occupied by various learned societies, the Royal Society, the Society of Antiquaries and others. Near the South Kensington Museum and the Albert Hall is the splendid block of buildings of the Imperial Institute, with its various permanent collections and exhibitions and institutions. Besides the British Museum Library the chief libraries are Lambeth Palace Library, the Guildhall Library, Sion College Library, the London Library (subscription), London Institute Library, and in addition large circulating libraries and many free public libraries supported by rates.

Educational Institutions.— At the head of these stands the London University (q.v.)' which promises to become the foremost scientific university in the kingdom. Other institutions are denominational colleges for theology (in some combined with general education), the Royal Naval College, Greenwich; the Royal Military Academy, Woolwich; the Royal College of Science; the medical schools attached to the hospitals; Royal Academy of Music; Royal College of Music; Trinity College, chiefly for music; several colleges for ladies, etc. Among the grammar and secondary schools are Saint Paul's School, founded in 1509, which provides a free education for 153 boys, with scholarships to Oxford and Cambridge; the Merchant Taylor; Westminster School, founded by Queen Elizabeth in 1560; University College School, King's College School, City of London School, Mercers' School and schools of the several other city companies. Besides the above and numberless private schools, there are the city and guild institutions for technical education, many high schools for girls, many free schools, numerous schools of the National Society, and the numerous schools of the London county council. Several polytechnics and centres of technical education have been equipped and supported by the London county council, who have also established a system of county scholarships for students. The county council expends annually about $25,000,000 on elementary and $5,000,000 on higher education. Of this sum about $10,000,000 is furnished by the government, the remainder being raised through a special tax levied by the council.

Scientific Associations, etc.— Associations for promoting science, art, learning, etc., are exceedingly numerous. The chief are the Royal Society, Burlington House, founded in 1660; the Society of Antiquaries, in the same building, originally founded in 1572; the Royal Academy (of painting, etc.), in Trafalgar square, founded in 1768; the Royal College of Physicians, founded by Linacre, physician to Henry VIII, in 1518; the Royal College of Surgeons; the Royal Geographical Society, with a choice geographical library and large collection of maps; the Institution of Civil Engineers; the Royal Institute of British Architects, possessing a good library of architectural works; the Royal Institution of Great Britain, established in 1799; the Royal Horticultural Society, which possesses the botanic gardens in Regent's Park, as also at South Kensington and at Chiswick; the Royal Astronomical Society; the Royal Asiatic Society; the British Association; the Zoological Society, with its collection of animals in Regent's Park; the Geological Society and the Anthropological Institute.

Hospitals and Charitable Institutions.— Besides the three great endowed hospitals, Saint Bartholomew's, in West Smithfield, Guy's, Southwark, and Saint Thomas, Lambeth, occupying a large and splendid range of buildings on the Thames Embankment opposite the Houses of Parliament, there are the London Hospital, Saint George's Hospital, the Middlesex Hospital, Westminster Hospital, Charing Cross Hospital, King's College Hospital, University College Hospital, Saint Mary's Hospital and Royal Free Hospital, all with medical schools attached. Other general hospitals are the Great Northern Hospital, the West London Hospital and the Metropolitan Hospital; besides the German Hospital, Dalston; hospitals for special diseases, as consumption, fever, cancer; hospitals for women, for children, etc. Bethlehem Hospital (Bedlam), in Saint George's Fields, south of the river, is the chief hospital for lunatics; Saint Luke's Hospital is also for insane patients. The Foundling Hospital (see FOUNDLING) is rather an asylum for illegitimate children generally than a hospital for foundlings. Chelsea Hospital and Greenwich Hospital are institutions by themselves.

Prisons.— There are altogether about a dozen criminal prisons. The most celebrated of these, Newgate, near Saint Sepulchre's Church, a gloomy and massive structure, the scene of a great many executions, was pulled down in 1903. Millbank penitentiary, or prison, an immense brick edifice with external walls enclosing upward of 16 acres, has been demolished, and the site utilized partly for workmen's dwellings, and partly for the Tate Picture Gallery. The chief existing prisons are the Wandsworth prison, Holloway prison (for females); the model prison, Pentonville, containing 1,000 cells, in which the inmates are taught useful trades; Wormwood Scrubs prison, a large building standing on the borders of London.

Squares and Public Monuments.— The squares of London are characteristic; many of them are of great beauty and extent, and planted with shrubbery. Among them are Saint James' square, north of Pall Mall; Eaton, Belgrave (10 acres), Grosvenor, Portman, Cavendish squares, all in the West End; Russell square (10 acres), Bedford, Bloomsbury, Tavistock and Euston squares, in the west central part of the town; Trafalgar square, at Charing Cross, fronting one of the principal thoroughfares, and adorned with public buildings, fountains, the Nelson Column and statues of Charles I, George IV and others. The most conspicuous public monuments are "the Monument" on Fish Street Hill, London Bridge, a fluted Doric column, 202 feet high, erected in 1677, in commemoration of the great fire of London; the York Column, at the south end of Waterloo Place, a plain Doric pillar of granite, 124 feet high, surmounted by a bronze statue of the Duke of York; a fluted Corinthian column in Trafalgar square, 176½ feet high, raised in honor of Nelson, and surmounted with a colossal bronze statue of the hero, having the pedestal decorated with bronze sculptures in high relief, and four magnificent lions, by Sir E. Landseer, at the angles; the Albert Memorial, Hyde Park, the most splendid and costly monument of recent times, being a Gothic structure, 176 feet high, with a colossal seated statue of the prince under a magnificent canopy elaborately sculptured and adorned; and the magnificent memorial to Queen Victoria (designed by Sir Thomas Brock and unveiled in 1911) with its beautiful surroundings in front of Buckingham Palace. There is a statue of the Duke of Wellington in front of the Exchange, and a statue of Sir Robert Peel at the top of Cheapside. Statues of Sir Charles J. Napier, Sir Henry Havelock and General Gordon stand in Trafalgar square. On the Thames Embankment, not far from the Temple, now stands the Egyptian obelisk known as Cleopatra's Needle; and west of it are statues of Robert Raikes, the founder of Sunday schools, General Outram, John Stuart Mill and others. In Waterloo place is a memorial to the Guards who fell in the Crimea, and here is also a statue of Sir John Franklin. An equestrian statue of the Duke of Wellington at Hyde Park Corner was erected in 1888. A monument to Sir Hugh Middleton, who brought the New River water to London, has been erected on Islington Green. Among other memorials are the Westminster Crimean Memorial, in the open space at the west of the Abbey; the Peabody statue behind the Royal Exchange; an equestrian statue of Prince Albert in Holborn Circus, a statue of Carlyle on Chelsea Embankment and of Lord Beaconsfield in Westminster Palace Yard.

The Parks.— Of these the finest and most fashionable is Hyde Park (q.v.), which lies between the Uxbridge and Kensington roads, and contains about 364 acres. Kensington Gardens (275 acres), with which Hyde Park communicates at several points, are beautifully wooded and finely laid out. Here carriages are not admitted. Saint James' Park (93 acres) extends from Buckingham Palace to the Horse Guards, and in its centre is an ornamental sheet of water, studded with islets covered with trees and shrubs, and around which swim a great variety of aquatic fowls. The Green Park, 53 acres in extent, lies between Saint James' Park on the south and Piccadilly on the north. Regent's Park, on the north side of London, covers an area of 472 acres. Round the park is a drive nearly three miles long, and an inner circular drive encloses the Botanic Gardens. At the north end are the Zoological Gardens, to which a fine broad avenue leads along the centre of the park. Battersea Park (200 acres) is on the south bank of the Thames, opposite to Chelsea Hospital. Victoria Park (217 acres) is in the northeast of London, laid out and planted as a place of recreation for the poorer inhabitants of this part of London. Southwark Park (63 acres) is another artificially formed recreation ground. Greenwich Park (185 acres) is one of the most delightful features of South London, and has great natural beauties; the famous Greenwich Observatory is situated here. There are many other parks acquired for use of the public during late years. Brockwell Park and Dulwich Park in the south; Avery Hill in the southeast; Finsbury Park and Clissold Park, on the north borders of London, are the most extensive. But even more typically a part of modern London are the numerous and beautiful heaths and commons preserved for the public: Hampstead Heath on the north, Hackney Marsh on the northeast, Blackheath and Plumstead Common on the southeast and Tooting and Streatham commons on the south.

Places of Popular Resort.—There are various places of popular resort in London. The Exhibition at Earl's Court, a vast open-air entertainment accompanied by exhibits of special descriptions arranged in courts and buildings within the grounds, is the largest. Olympia at Kensington is of less magnitude. The Zoological Gardens and the Botanical Gardens, both in Regent's Park, are very largely frequented. The People's Palace, established by contributions of the benevolent, in the East End of London (Mile-end road), and opened in 1887, provides a hall for concerts and other entertainments, a library and reading-rooms, swimming baths, gymnasiums, social meeting-rooms, winter garden, technical schools, etc. Outside London there are other places of this description. The most important is the Crystal Palace (q.v.), at Sydenham, formed to a considerable extent of the materials of the exhibition building of 1851, removed from Hyde Park. It was originally designed as a great educational museum of art, natural history and ethnology; and its gardens and fountains were to rival or surpass those of Versailles. For years music has taken an important place in the arrangements of the palace. Entertainments of a merely amusing character have also been largely introduced. A somewhat similar building is the Alexandra Palace, occupying a conspicuous site on Muswell Hill on the north. Both the Crystal Palace and the Great White City at Shepherd's Bush, also an amusement centre, were used for military purposes during the Great European War. Kew Gardens (q.v.) on the west and Hampton Court palace (q.v.) and grounds, built by Cardinal Wolsey and enlarged by William III, are situated further out toward the southwest.

Lighting, Sewerage and Water.— London is supplied with gas by three separate companies. These companies include in their area of supply a considerable district outside London. Since 1886 a large number of electric lighting companies have come into existence· in 1916 13 companies and 16 local administrations possessing statutory powers to supply electricity. The county council has been given powers to buy out the electricity undertakings. The sewage works, with which the metropolitan board was charged, were formally opened in 1865. The system consists of lines of intercepting sewers on both sides of the Thames intersecting the old outlets, which are retained for service during heavy rainfalls. It consists of three main lines on the north of the river, at different levels, called, respectively, the High Level, Low Level and Middle Level sewers; and of three on the south side, called the High, the Effra and Low Level sewers. The lines on the north side converge at Lee River, whence, after the Low Level sewage has been pumped to the higher level, the whole flows in five parallel brick culverts, built in an embankment upward of five miles in length, on to the Northern Outfall and reservoir, about 14 miles below London Bridge. On the south side the Low Level sewage is pumped to the higher level at Deptford, whence the whole is conveyed to a point near the mouth of the river. Works have been established for precipitating the sewage; the deposit after precipitation is carried out to sea and deposited several miles from land. There were formerly eight water companies supplying London and an extensive area around, extending into Essex, Hertfordshire, Kent, Middlesex and Surrey. In June and July 1904, the undertakings of these companies were transferred to the metropolitan water board. The total quantity of water supplied in 1914–15 amounted to nearly 243,000,000 of gallons daily, an average per head of 36.08 gallons. About 56 per cent of the supply is drawn from the Thames area, 24.7 from the Lee, and 19.3 from wells and springs. The reservoir now under construction at Chingford, with those to be built at Littleton and Stanwell, will enable the board to face its obligations for the next 20 years. By an act passed in 1852 all the companies making use of the Thames are obliged to draw from above the limit of the tidal flow. Even above this point the water is not free from pollution by the sewage of numerous populous towns and by the drainage of richly-manured land. Means are adopted for storing the water, and it is all filtered through layers of gravel and sand before entering the mains; but the system of supply is liable to various objections.

Cemeteries.— The provision of cemeteries for London is in the hands of the metropolitan borough councils and of private companies. Many of those provided by the borough councils and most of those under private management are situated outside the county. Amongst the latter may be mentioned Kensal Green Cemetery, in which several royal personages have been buried. It was opened in 1832, occupies about 70 acres of ground, and is tastefully planted and laid out. Kensal Green Roman Catholic Cemetery occupies 30 acres. The City of London Cemetery is at Ilford, in Essex.

Communications.— The London population commands two systems of locomotion, namely, internal and external. The former has reference to the purely London requirements, and is by means of omnibuses, tramways, steamboats and railways; the latter has reference to the connection of London with the rest of the kingdom and the Continent, and are by canals, railways and the Thames. The internal traffic of London has become almost overwhelming. There are 626 railway stations in Greater London and 669 route miles of railways. In 1913 there were 1,933 horse-drawn cabs, 6,308 electric tramcars and motor omnibuses and only 182 horse omnibuses and tramcars and 8,376 motor cabs. There were also available the Metropolitan, the Metropolitan District and the electric railway systems on other lines.

These are extending in all directions. The great English railways long ago reached the limit of their ability to cope with suburban traffic in and out of London. The old underground railway was designed to be complete in an inner and outer circle, but the outer circle was found to be insufficient before it was built, while the inner circle does not even touch what might be called suburbs. Yet so long as it was without competition the two companies owning this system drew great dividends and ignored the demands of their dependent patrons for better service. Not until competition arose in the shape of the Central London Electric Tube Railway did the directors of the District and Metropolitan lines bestir themselves. American enterprise in acquiring control of the District Underground brought a flood of underground railway schemes forward, and Parliamentary committees were kept busy deciding between rival schemes. They have been careful to reserve all manner of rights to the government, refusing, for instance, to grant any route unless the proposed company agreed to provide and maintain a subway for pipes and wires along its lines. This is an effort to unravel the tangle of such things which the least upturning of the streets shows. These lines are also refused complete independence of each other, and are compelled to arrange transfers and joint time tables.

There are 157 miles of tramways in London, almost entirely under the county council, and Greater London has 353 miles. For 1913–14 the county council tramways carried 522,952,640 passengers, and the receipts were £2,202,489. Some idea of the immensity of the traffic may be obtained from the Greater London passenger statistics for 1913: Tramways, 811,397,317; omnibuses, 733,931,201; local railways, 462,-019,537; trunk railways from a 30-mile radius, 250,000,000. The continuous battle between road and rail for public support, and the encroachments of the latter on the former, may be illustrated by stating that whereas in 1909 60 per cent of journeys were by road and 40 by rail in 1913 the figures were 68 by road and 32 by rail. Motor power for passenger traffic has developed with enormous rapidity in London: in 1914 the fast horsed vehicles had dwindled down to 4 per cent of the fast vehicles on the street, and that within a period of 12 years. In 1911 they formed 13 per cent. This development as regards goods traffic has been comparatively slow: 85 per cent horse-drawn vehicles compared with 94 per cent in 1911. The faster moving motor power has assisted materially in the migration of the population from the inner to the outer ring; but the liability to accidents is greater, the number of fatal street accidents having increased from 451 in 1911 to 658 in 1914. Previous to 1905 the Thames had almost been allowed to drop out of existence as a local traveler's route. In that year the county council inaugurated a steamboat service between Hammersmith and Greenwich, with calls at 25 intermediate points; but the venture did not prove a success, and the especially built fleet of 30 steamboats was sold.

The principal railway stations are: The Great Eastern, Liverpool street, Fenchurch street; the London, Tilbury, and Southend, Fenchurch street; the London and North Western, Euston; North London, Broad street; Great Western, Paddington; the Great Northern, King's Cross; Midland, Saint Pancras; Great Central, Marylebone; South Eastern, London Bridge, where there is a congeries of stations, Charing Cross and Cannon street; London, Chatham and Dover, Ludgate Hill and Victoria; the London, Brighton and South Coast Railway, Victoria and London Bridge; the South Western, Waterloo. Many of these stations communicate by the Metropolitan and District railways, distinct systems, but both popularly known as the "underground," affording means of internal communication within the city. Many of the termini are elaborate piles of costly architecture, and have associated with them large and handsome hotels. The Thames affords communication by steam vessels with the most important points on the British and Continental coasts, as well as with all parts of the world.

Manufactures.— It is impossible within the limits of this article to specify the different kinds of articles manufactured in London. It contains the largest breweries, distilleries and sugar refineries in the kingdom; was long the principal seat of silk weaving; has extensive manufactures in metal, including machinery of all kinds, plate jewelry, watches and brass works, and an enormous production of books and prints. Millinery, the making of clothes and of boots and shoes are also extensive branches of industry. Besides these, there are cabinet making, coopering, coach building, rope making, leather working, hat making, shipbuilding, mast making, etc., all of which are departments of manufacture conducted on a large scale; and there are numerous extensive chemical works, soap manufactories and dye works. It is not generally known that London is a very large manufacturing centre.

Commerce, Docks, etc.— For customs purposes the port of London may be said to extend from Teddington Lock to the sea, a distance of 70 miles. Up till within recent years the upper section was under the care of the corporation of the city for sanitary purposes, under the Thames Conservancy for navigation and under all sorts of other authorities for various other purposes, London enjoying the unenviable distinction of being probably the worst-managed port in the world. In 1908 a drastic reform was effected, under which the various and conflicting division of powers was abolished, and the Port of London Authority created to administer everything concerning the port. It consists of a chairman and vice-chairman and 10 nominated and 18 elective members, who are chosen by various persons and bodies representative of the trade of the port. Under its enlightened management London is rapidly becoming one of the most up-to-date ports in the kingdom.

Until the beginning of the 19th century there were no wet docks in the port of London, and ships were loaded or discharged in the river or at wharves. The West India docks, the first to be constructed, were opened in 1802. The docks, some of which are of great extent, are surrounded by wharves, sheds, storehouses, vaults and warehouses of the most spacious kind. Saint Katherine's docks, London docks, the West India docks, the East India docks and the Millwall docks (in the Isle of Dogs) extend along the north side of the river from the Tower to Blackwall; and on the south side, between Rotherhithe and Deptford, are the extensive Surrey Commercial docks (350 acres), forming one compact system of water basins, extending from the port to Limehouse Reach. The Blackwall tunnel blocks the channel to the upper docks for large vessels, and steamers are compelled to discharge at from 10 to 20 miles below London Bridge. The dock accommodation of the port was greatly increased by the construction of the Victoria and Albert docks (opened respectively in 1855 and 1880), which follow next in order on the north side of the river (opposite Woolwich), which, with extensions, will have a combined water area of 252 acres. Besides these, there are the splendid docks at Tilbury, on the Essex shore opposite Gravesend, 22 miles by river from the Tower, constructed for the purpose of admitting the largest vessels at any state of the tide. Here the docks have an area of 90 acres, with two large graving docks. The total water area of the London docks is 645 acres. From London Bridge to Blackwall Tunnel the channel is from 450 to 500 feet wide and 14 feet deep at low water; from Blackwall Tunnel to the Royal Albert dock it is from 500 to 600 feet wide and from 16 to 20 feet deep; from the Royal Albert dock to Crayfordness 600 feet wide and 30 feet deep, and from Crayfordness to the Nore it is 1,000 feet wide and 30 feet deep. The vessels registered at the port in 1914 numbered 3,313, with an aggregate tonnage of 2,513,588 tons.

London is the greatest importing and distributing centre in the kingdom, holding as regards imports a position analogous to that held by Liverpool in exports. For East and West India goods, London is the great port; tea, sugar, tobacco, wine, corn, timber, tallow, hides, wool and drugs form large items. Value of imports in 1913, £253,879,289; exports (of United Kingdom), £99,104,682 (of foreign and colonial goods), £58,808,178. The revenue of the Port of London Authority for the year ending 31 March 1915 was £3,738,795, and expenditure £3,550,987.

Administration.— Greater London has a representation of 62 members in the House of Commons. London is governed by the county council with the city corporation and 28 metropolitan boroughs administering local matters. The most ancient civic officer of London is the lord-mayor of the city of London. He is annually elected from among the aldermen who have been sheriffs of the city, on 29 September, and installed in office on 9 November, when a procession takes place, called the lord-mayor's show. The court of aldermen consists of 26 members, including the lord-mayor. They are chosen for life by the taxpayers of the wards. There are 27 wards. One alderman is elected for each of 24 wards, one for 2 wards, and one serves (is not elected) for a nominal ward. They are properly the subordinate governors of their respective wards, under the jurisdiction of the lord-mayor, and preside over the business in the courts of Wardmote. The civic sheriffs, two in number, are annually chosen by the livery or general assembly of the freemen of London. The common council is a court consisting of 206 representatives returned by 26 of the wards in proportion to their relative extent; the 27th, or Bridge Ward Without, being represented by an alderman. The general business of this court is to legislate for the internal government of the city, its police, revenue, etc. The recorder is generally a barrister of eminence, appointed for life by the lord-mayor and aldermen as principal assistant and adviser to the civic magistracy and one of the justices of oyer and terminer. The "livery" of London is the aggregate of the members of the several city companies, of which there are 75. Of these 12 are termed great companies, and from one or other of them the lord-mayor was formerly chosen. In order of precedence they are: The Mercers, Grocers, Drapers, Fishmongers, Goldsmiths, Skinners, Merchant Tailors, Haberdashers, Salters, Ironmongers, Vintners, Clothworkers. Many of the companies are very rich and possess large halls. Besides the ancient city of London there are under the act of 1899 the 28 metropolitan boroughs, already enumerated, each of which for local purposes is governed by a mayor, aldermen and council. The county council consists of the chairman of the council, 19 aldermen and 118 councillors, the latter being elected by the taxpayers of the several divisions, which are, however, not coincident with the boroughs. Other London authorities are 31 boards of guardians, dealing principally with poor relief; four boards of school district managers and two boards of sick asylum district managers, appointed from among their own number by the guardians of those unions which are combined into districts; the metropolitan asylum board, partly elected by the guardians and partly nominated by the local government board, and whose chief duty is provision for infectious sick and harmless insane; the central (unemployed) body and 29 distress committees, for the provision for distress from lack of employment, the latter appointed by the city of London corporation and the metropolitan borough councils, the former (with the exception of eight members) appointed by the London county council, the distress committees and the local government board; the metropolitan water board, appointed by the London county council and the local authorities in the area supplied by the board. The cost of administration of city and county is about £18,000,000 annually. Assessed valuation, 1915–16, £45,384,722.

Including city, county and borough councils, district councils and boards of guardians, about 170 authorities minister to the needs of Greater London — to what is really one community.

The Police.— The city police, confined to the city proper, is administered by the city corporation as a municipal force, and numbers about 1,161 men. The metropolitan police is not municipal. It is administered by a commissioner appointed by the Home Office. It consists of nearly 22,500 men, whose central offices are New Scotland Yard, a massive building on the Embankment near Westminster Bridge. Its area of jurisdiction extends for 15 miles from Charing Cross.

For postal purposes the authorities divide the major portion of Greater London into districts designated by their initial letters, E. C., W. C., W., S. W., S. E., E., N., N. W., signifying East Central, West Central, etc.

History.— Though, by the evidence of its name and by archæological remains, London was occupied by the Celtic Britons before the arrival of the Romans, it was not till the Roman era that it became a place of importance. There were probably two Roman Londons: the first destroyed by Boadicea and probably consisting of the area extending from near the Tower on the east by the course of the Langbourne (now preserved in Langbourne ward); on the north, by the course of the Walbrook on the west and the Thames on the south; the second probably coincident with the mediæval walled city. The Roman walls were destroyed by the Danes and were restored by King Alfred. After the Romans left Britain, London assumed a certain amount of independence, and throughout the Anglo-Saxon period it appears to have supported the monarch who was acceptable to the rest of the kingdom. Alfred was the first king of the Anglo-Saxons who thoroughly understood the importance of its military position. It suffered by fire in 764, 798 and 801. It was sacked by the Danes, who obtained a considerable settlement in Southwark and on the western boundary of the city beyond the Ludgate. At the Conquest London treated with and finally submitted to William. William's first act was to dominate the city by building his military stronghold, the beginning of the Tower of London. He then granted the city its ancient rights by a charter, which is still preserved; on the accession of Henry I a new charter was granted, and the charter grants increased considerably under the Plantagenets, while its municipal privileges were made the standard for governing many of the municipal boroughs in the provinces. London sided with Stephen against Matilda, took part in the struggle against John for Magna Charta, was severely oppressed by Henry III, strongly supported Edward IV and the Yorkist party in the wars of the Roses, and was faithful to Richard III; it equipped and dispatched ships to the navy collected to fight the Spanish Armada, and its citizens, officered by the aldermen of the city, fought for the Parliamentarian side against Charles I. Under the later Stuarts and the Georges it became more political than municipal and lost much of its ancient power. In the reign of Henry II the walls on both sides of the river are described in a contemporary account as supplied with numerous towers; London Bridge, erected instead of a wooden one, was begun in 1176 and finished in 1209. This was to a great extent the same that was taken down in 1832. In 1218 the forest of Middlesex was cleared, and that portion of London north of the city began to be built. In the year 1328 the village of Southwark was incorporated with the city, as it had previously served as a place of refuge for malefactors. In 1349 and 1361 London was visited by the plague. In 1381 broke out the rebellion of Wat Tyler, who fell by the hands of the lord-mayor, hence the dagger on the city arms. In 1416 street lamps were introduced; in the same century some of the principal streets were paved, and wooden houses began to be replaced by others of brick. In the next century improvements were continued, and Westminster was connected with the city by a row of noblemen's mansions along the river, the last of which, Northumberland House, has made way for the road leading from Trafalgar square to the Embankment. In the 17th century Spitalfields was covered with houses, and the space north of the Strand as far as Holborn and from Temple Bar to Saint Martin's lane was extensively built on, as well as the neighborhoods of Charing Cross and Pall Mall. The New River was completed and many houses were supplied with water; sewers were dug; smooth pavements were laid down for passengers and hackney coaches came into general use. But the streets were so narrow and dirty and the houses in so filthy a state that the city was scarcely ever exempt from the plague, which sometimes committed great ravages. In 1666 the great fire broke out and spread over 336 acres, destroying 13,200 houses, 90 churches and many public buildings. In rebuilding considerable improvements were introduced, and a fire in Southwark 10 years after gave a similar opportunity of improving that district. Population and trade now rapidly increased, partly from the immigration of French Protestants driven from their country by the revocation of the Edict of Nantes. In the 18th century London steadily advanced in extent, prosperity and splendor. In 1780 took place the Gordon Riots, when the mob was in possession of London for two days and committed frightful havoc. Since that disgraceful outbreak the peace of London has never been seriously endangered, and the troops stationed in and around the capital, together with the effective police force that now exists, seem quite adequate to insure it against any similar disturbance. The extension and improvements which took place during the 19th century are greater than in any former period, and further changes of great importance are in operation. The most remarkable event of the century in the history of London was the carrying into effect in 1851 of the first great truly international industrial exhibition, which has since led to numerous exhibitions of a similar kind both there and abroad. In 1862 took place the second great international exhibition, and since that time various exhibitions of an international character and largely representing the colonies have been held in specially constructed buildings at South Kensington. The history of London contains many episodes of vast importance to the nation as well as to London itself. As now united for government, it will have to face problems of vast moment. The largest, most populous and richest city that civilization has ever produced, the study of its history and its development must ever be of great importance and interest.

For incidents in London during the Great War and the air raids on the city see WAR, EUROPEAN.

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LONDON, Ohio, village and county-seat of Madison County, on the Pittsburgh, Cincinnati, Chicago and Saint Louis, the Cleveland, Cincinnati, Chicago and Saint Louis and the Ohio Electric railroads, about 25 miles southwest of Columbus and 65 miles northeast of Cincinnati. It is situated in an agricultural and stock-raising region. The manufactures are agricultural implements, tiles, flour, lumber, shoes and cigars. Meat-packing and corn-canning are also of importance. The village has a public library, courthouse, State penitentiary farm and a State fish hatchery. The village owns and operates the electric-light plant. Pop. 3,800.

LONDON, Declaration of. See DECLARATION OF LONDON.

LONDON, Pact of. An agreement entered into and signed by the representatives of Great Britain, France and Russia on 5 Sept. 1914, according to which

> The British, French and Russian governments mutually engaged not to conclude peace separately during the Great War.
>
> The three governments agreed that when terms of peace came to be discussed no one of the allies would demand conditions of peace without the previous agreement of each of the other allies.

The declaration was signed by Sir Edward (now Viscount) Grey, M. Paul Cambon, French Ambassador in London, and the late Count Benckendorff, the Russian Ambassador. Japan became a party to the agreement on 19 Oct. 1915, and Italy on 30 Nov. 1915. The United States did not subscribe to the treaty, for, as Mr. A. T. Balfour declared in Washington on 25 April 1917, «no treaty could increase the undoubted confidence with which we look to the United States, who, having come into the war, are going to see that war through. If there is any certainty in human affairs, that is certain.»

LONDON, Treaties and Conventions of. The following are the most important of the treaties and conventions concluded in London in modern times. The Quadruple Alliance, formed 2 Aug. 1718. On 6 July 1827, a treaty was signed between England, France and Russia for regulating the affairs of Turkey and Greece, which led to the establishment of the kingdom of Greece. On 22 April 1834, a quadruple alliance was formed between England, France, Spain and Portugal against the claims of Don Carlos and Don Miguel to the crowns of Spain and Portugal. On 15 July 1840, a treaty was concluded between England, Russia, Austria and Prussia to compel Mehemet Ali to restore Candia and Syria to the Porte, and on 27 November, at the conclusion of a short campaign by an Anglo-Austrian army in Syria, Mehemet Ali agreed to the terms of the treaty. A convention to close the Dardanelles against ships of war was signed on 13 July 1841; and a convention between France and England for suppression of the slave-trade, 29 May 1845. Austria, France, England, Prussia, Russia and Sweden were parties to a treaty, signed 8 May 1852, for settling the succession to the Danish crown and guaranteeing the integrity of its dominions in relation to the duchies of Schleswig-Holstein. The rights of the German Confederation were reserved and the claims of the Duke of Augustenburg on the duchies relinquished on satisfaction. On 13 March 1871, at a conference of the great powers, the neutralization of the Black Sea, effected by the Treaty of 1856, was abrogated. The neutralization of Luxemburg was guaranteed by the five powers at the conference of London, 11 May 1867. The Convention of London, which was concluded on 27 Feb. 1884, between the Transvaal and Great Britain, abrogated the Pretoria Convention of 3 Aug. 1881, and instead gave the Transvaal (thenceforward to be known as the South African Republic) independence in regard to its internal affairs, but reserved to the queen the right of veto over all treaties concluded «with any state or nation other than the Orange Free State,» or «any native tribe to the eastward or the westward of the Republic.» See DECLARATION OF LONDON.

Following on a conference of the 10 leading maritime powers convened in London on 4 Dec. 1908, a code of rules was drawn up in February 1909, under the title of the Declaration of London, for the purpose of unifying international practice in the treatment of commerce on the high seas in time of war. This declaration bade fair to revolutionize the position of Great Britain, as the leading maritime power, in wars of the future. Great Britain's traditional policy has been to maintain the right of capturing and confiscating the goods of alien enemies found in enemy ships, and also contraband of war found in neutral vessels. Under the Declaration of Paris, 1856, the right to capture enemy goods in neutral ships was given up. Under the Declaration of London a further step was taken, and enemy property at sea was to be treated on practically the same footing as enemy property on land. Its advocates contended that it would save England from many of the difficulties she might otherwise experience in time of war in securing supplies; and its opponents contended that it would mean a virtual abrogation by England of the advantages her sea power gave her, especially in the destruction of an enemy's commerce. The proposed adoption of the Declaration of London gave rise to a spirited controversy in England. At the instance of the British government, the Declaration passed the House of Commons, but was refused ratification by the House of Lords. Accordingly the Declaration of London failed to secure that unanimous consent of the subscribing powers necessary to put it into operation. At the outbreak of the Great European War in August 1914 Great Britain announced her intention to adhere to the terms of the Declaration of London, but this attitude was later abandoned and the constricting pressure of her sea power on the commerce of the Central Powers was exerted with increasing vigor by the application of her traditional policy. This action led to vigorous protests from neutral powers, headed by the United States. See WAR, EUROPEAN.

LONDON, Treaty of (1915). A secret agreement concluded between Italy, France, Great Britain and Russia on 26 April and finally signed on 9 May 1915, declaring the terms under which Italy agreed to enter the war on the side of the Entente Allies. «By the future treaty of peace» Italy was to receive the Trentino, the whole of Southern Tyrol, as far as its natural and geographical frontier, the Brenner Pass; the city of Trieste and its surroundings, the county of Gorizia and Gradisca, the whole of Istria as far as the Quarnero, including Volosca and the Istrian Islands, Cherso and Lussin, as also the lesser islands of Plavnik, Unia, Canidoli, Palazzuola, S. Pietro Nerovio, Asinello and Gruica, with their neighboring islets. The province of Dalmatia «in its present extent» was also stipulated to become Italian, as well as all the islands north and west of the Dalmatian coast. Two sections of the Montenegrin coast were to be neutralized, while certain districts on the Adriatic were to be included in the territory of Croatia, Serbia and Montenegro (Jugoslavia). The port of Durazzo was to be assigned to «the independent Mohammedan state of Albania,» of which Italy was to conduct the foreign relations. In Libya, Africa, Italy obtained recognition of all the rights and prerogatives reserved to the Sultan by the treaty of Lausanne. In the event of an extension of French and British colonial possessions in Africa at the expense of Germany, the right of Italy would be recognized to demand certain compensations in territories bordering on French and British colonies. The contracting parties agreed that the Mohammendan holy places were to be left in the possession of an independent

Mohammedan state. The Holy See was not to be permitted to intervene by diplomatic action in regard to peace or questions arising from the war. Finally, Great Britain undertook to provide Italy with a loan of £50,000,000 ($250,000,000) on favorable conditions, and Italy agreed to enter the war within one month from the signing of this treaty, the terms of which were to be kept secret.

The treaty was first made public by order of the Bolsheviki Foreign Minister Trotzky in November 1917 as a protest against «secret diplomacy.» See WAR, EUROPEAN.

LONDON BRIDGE. A celebrated bridge connecting the city of London with the Borough. It was designed by John Rennie and built by his sons (1825–31). Its dimensions are as follows: Length, 928 feet; width, 54 feet; height above the river, 56 feet. An immense traffic passes over the bridge daily. The present structure took the place of a stone bridge (completed 1209), which was a short distance farther down the river.

LONDON CLAY, *in geology and palæontology,* a formation of the Lower Eocene Age; so called from its existing at or near London, England. It consists of a tenacious brown and bluish-gray clay, with layers of concretions called septaria. It has a maximum thickness of 600 to 700 feet.

LONDON COMPANY, a joint-stock company organized in London, in 1606, by gentlemen and merchants for the purpose of founding an English colony on the Atlantic coast of North America south of 41° north latitude. A council was established in England which controlled the company. On 23 May 1607 Jamestown was founded by the company. It was governed despotically until 1619 when a representative assembly was instituted. The charter was annulled by the king in 1624 and its powers and interests were vested thereafter in the Crown. Consult Brown, A., 'The First Republic in America' (Boston 1898); Ellyson, J. T., 'The London Company of Virginia' (New York 1908); McDonald, W., 'Select Charters and Other Documents' (ib. 1899); Tyler, L., 'England in America' (1904).

LONDON COUNTY COUNCIL. The county of London, nearly 120 square miles in area, is split up into 29 districts for local administrative purposes. Of these, two are cities, those of London and Westminster; one is a royal borough — Kensington — and 26 are boroughs. Each is self-contained and self-governing for all purely local matters and the different districts are clearly defined and recognized. There are other areas for other purposes — for instance, the Poor Law is administered by 31 duly elected boards of guardians, but the districts controlled by these boards do not exactly correspond with those governed by the borough or city councils. It is expected that future legislation may do away with this anomaly and make the Poor Law areas the same as those of the boroughs, possibly also abolishing the boards of guardians and transferring their duties to the borough councils. On the other hand there are those who predict the abolition of the borough councils also and the unification of London under one central authority. The present system leaves much to be desired, if only for the equalization of rates, each borough differing from the others in the amount annually required — the inhabitants of the poorer districts, with their smaller rateable value, having as a rule to pay much higher rates than their more fortunate fellow-citizens in districts where better conditions prevail.

Up to 1855 there was no uniformity of any sort for local administration. The city of London, the «one square mile,» had from time immemorable of course been a recognized unit, with well-defined duties and responsibilities, but round it had grown up a number of districts, north and south of the river, each with different forms of administration, obtained in most cases by special acts of Parliament. In 1855 the Metropolis Management Act attempted to reduce chaos to cosmos. It created 23 administrative vestries and 15 boards of works elected by the smaller vestries, in addition to the city corporation. These bodies again elected representatives to serve on the metropolitan board of works. The latter gave place to a directly elected body — the London county council — in 1889. In 1899 the London Government Act was passed and came into force on 9 Nov. 1900. It has 118 elected members. This act left the London county council and city corporation untouched, but abolished all the vestries and local boards of works (of which there were 29 and 12 respectively at the date of the act), setting up in their places 28 borough councils, of various sizes, rateable values and population. The smallest one is Holborn, with 405 acres, and the largest Wandsworth, with 9,285. In point of view of population, Holborn is the smallest with 49,357, and Islington the largest with 327,403. The death-rate varies from 11 to 18 per 1,000; the valuations between a maximum of £63 and a minimum of £4; the rating between 6/ in the £ and 11/–. The heaviest rates are in the poorest and least healthy districts.

Each borough is governed by a mayor, aldermen and councillors, the numbers of the two latter being fixed by an order in council. The maximum number of members of the councils are 10 aldermen and 60 councillors in addition to the mayor, who need not previously have been a member of the council, but must be qualified to be one. The mayor may receive any remuneration the council may think reasonable. He is also, by virtue of his office, a justice of the peace for the county borough for the year of his mayoralty and the succeeding one. No one can be elected to any council unless he is either a parochial elector, or has resided in the borough for 12 months preceding his election. It is noticeable that by a special provision in the act no woman is eligible to hold any of the above offices, although this was not the intention when the bill was introduced. Once elected the councils remain in office for three years. The first councils took office on 9 Nov. 1900.

For details of the constituent boroughs of the county of London see under BATTERSEA; BERMONDSEY; BETHNAL GREEN; CAMBERWELL; CHELSEA; DEPTFORD; FINSBURY; FULHAM; GREENWICH; HACKNEY; HAMMERSMITH; HAMPSTEAD; HOLBORN; ISLINGTON; KENSINGTON; LAMBETH; LEWISHAM; PADDINGTON; POPLAR; SAINT MARYLEBONE; SAINT PANCRAS; SHOREDITCH; SOUTHWARK; STEPNEY; STOKE

NEWINGTON; WANDSWORTH; WESTMINSTER, CITY OF; WOOLWICH.

LONDON UNIVERSITY, England, established as a joint-stock company in 1826, received in 1836 two charters, one for an association retaining the name of London University and having power to examine candidates and grant degrees, and the other for a teaching body — the University College — entitling it to prepare students for the degrees conferred by the university. The object was to render academic honors accessible to all without distinction of creed or class. The university became purely an examining body, granting degrees to all who passed the prescribed examinations but not undertaking any teaching functions. In 1878 women were admitted to degrees. An influential movement in favor of the establishment of a teaching university in the metropolis arose, however; from 1888 commissions had the matter in hand and in 1898 the London University Act was passed to give effect to their recommendations. A commission appointed to draw up statutes and regulations for the university in accordance with the act had its work formally ratified 29 June 1900, and the newly-constituted university was established, the government granting the eastern and central portions of the Imperial Institute building to the university for its accommodation. The eight faculties comprise arts, science, law, medicine, theology, music, engineering and economics and political science and the degrees conferred are LL.D., LL.B., M.D., M.B., M.S., B.S., D.Sc., B.Sc., D.Lit., M.A., B.A., D.Mus., B.Mus. Candidates for any degree must first pass the matriculation examination, for which the subjects are Latin, English, mathematics, general elementary science and one other subject selected from a prescribed list, including Greek, French, German, Sanskrit, Arabic, elementary mechanics, chemistry, sound, heat and light, magnetism and electricity and botany. For the ordinary degrees of B.A. and B.Sc. two other examinations must be taken. In the faculty of arts the highest degree is doctor of literature. Examinations are held at provincial centres as well as in London. The incorporated colleges and schools of the university are 36 in number and include University College and King's College in all faculties; Hackney College, New College, Regent's Park College, Wesleyan College (Richmond), London College of Divinity in theology; Royal Holloway and Bedford Colleges in arts and science; the Royal College of Science; the South-Eastern Agricultural College, Wye; the medical schools of Saint Bartholomew's, the London, Saint Thomas's, Saint George's, the Middlesex, Saint Mary's, Charing Cross and Westminster hospitals; the London School of Medicine for Women; the Central Technical College of the City and Guilds Institute; and the London School of Economics and Political Science. The supreme governing body is the senate, consisting of the chancellor, 4 members appointed by the Crown, 17 members elected by convocation, 1 of them being the chairman of convocation, 2 each elected by the Royal Colleges of Physicians and of Surgeons, 1 appointed by each of the four Inns of Court and 2 by the Incorporated Law Society, 2 each chosen by University and King's Colleges, 1 representing the Corporation of London, 2 appointed by the London county council, 1 representing the City and Guilds Institute and 16 elected by the faculties. The senate is debarred from imposing any religious test, or from imposing any disability on the ground of sex. There are three standing committees of the senate, namely, the academic council, the council for external students and a board to promote the extension of university teaching. The chancellor, vice-chancellor and chairman of convocation are ex officio members of all three committees. Convocation consists of the chancellor, the vice-chancellor, the members of the three standing committees and the registered graduates of the university of prescribed standing. The Parliamentary representative of the university is elected by the duly qualified male members of convocation.

In 1909 a royal commission was appointed to enquire into the affairs of the university, under the chairmanship of Mr. (now Lord) Haldane. The commission's report, issued in 1913, expresses the view that the entire organization of the university is radically defective; recommends certain limitations in the admission of external students to its examinations; the creation of a small executive senate predominatingly lay in character; organization by faculties; and effective control of the medical schools by the university. Steps are now being taken to carry out these recommendations.

The library of University College contains 150,000 books and pamphlets. In 1913–14 the total number of students who appeared for examination at London University was 11,920, and the total of internal students was 4,888. There are 1,078 accredited teachers.

LONDONDERRY, Charles William Stewart Vane, 3d MARQUIS OF, British military officer and diplomat: b. Dublin, Ireland, 18 May 1778; d. London, 6 March 1854. He served under Sir John Moore and (as adjutant-general) Sir A. Wellesley, in the Peninsula, distinguishing himself there at the battles of Fuentes D'Onora and Ciudad Rodrigo, was present at Lutzen and Leipzig and was English Ambassador to Berlin in 1813. He was Ambassador to Vienna the next year and Minister-Plenipotentiary at its congress in 1815. By his marriage with Miss Vane-Tempest he succeeded to immense estates in the county of Durham and devoted himself to their improvement and to the welfare of his tenantry. He succeeded to the marquisate of Londonderry on the death of his brother. Under his original name of Stewart he wrote the 'History of the Peninsular War' (1808–13); 'Narrative of the War in Germany and France, 1813–14' (1830); and edited the 'Correspondence' of Viscount Castlereagh, his brother (1850).

LONDONDERRY, or DERRY, Ireland, city, seaport, county borough, Parliamentary borough and assize town in the county of the same name, province of Ulster, on the Foyle, 23 miles from its mouth and 95 miles by rail north-northwest of Belfast. Waterside, a suburb on the opposite river bank, is united to the city by the iron Carlisle Bridge, 1,200 feet long. The houses of the town rise on the hill tier upon tier, while the summit is crowned by the cathedral. The ancient portion of the city is surrounded by a rampart 1,708 yards long. It contains a small square, called the Diamond, from which four main streets diverge. The walls are pierced by seven gates, giving communication with other parts of the town, the greater part of which lies outside the walls. The most important public buildings are the guildhall, the county courthouse, the post office, the custom-house, the harbor offices, the jail, Gwyn's Institution, the model school, Magee College, Foyle College, Saint Columb's College, the school of science and art, the lunatic asylum and Ebrington Barracks. The harbor is commodious and vessels of large tonnage can discharge at the quay, which extends for nearly two miles along the river and is provided with a graving-dock. An extensive foreign, colonial and coasting trade is carried on with English and Scotch ports, while Glasgow transatlantic steamers call at the mouth of the river. The principal export is agricultural produce; the chief imports are timber, grain, iron, coal, flaxseed, flour and guano. Shirt factories employ thousands of workers and there are timber-mills, grain-mills, foundries, coach-factories, bread and biscuit factories, distilleries and a ship-building yard. Intermediate education is supplied by Foyle College, founded in 1617, and by Saint Columb's Catholic College. Magee College, opened in 1865, besides teaching secular subjects, has a theological course adapted to young men studying for the Presbyterian ministry. The Anglican cathedral dates from 1633. The Roman Catholic cathedral is a massive and magnificent structure, opened in 1873. The population is about equally divided into Roman Catholics and Protestants. Derry originated in a monastic establishment founded by Saint Columba in the 6th century. It remained an ecclesiastical settlement until 1566, when it was occupied by the English in their wars with the O'Neills of Ulster. In 1608 the place was burned and the English governor slain by Sir Cahir O'Dogherty, one of the Irish chiefs of Donegal. During the 20 years that followed, the corporation of London, which obtained a grant of the place from James I, rebuilt the city, surrounded it with a wall, fortified it with cannon and gave it a new name. Henceforth it was known as Londonderry. Here the Protestants of Ulster took refuge at the Revolution of 1688 and held the fortress against the forces of James II, the siege lasting from 19 April till 30 July 1689; the defense by untrained men against superior numbers being regarded as one of the most heroic and successful military actions of modern times. Pop. 40,799.

LONE STAR STATE, The, a name given to Texas from the device on its coat of arms: one star, or a «lone star» in the centre of a wreath.

LONE WOLF (Guipago), a noted Indian chieftain of the Kiwoa tribe: d. 1879. He became head chieftain of his tribe in 1866 but refused to bring the tribe into a reservation, in accordance with the Medicine Lodge Treaty which he had refused to sign in 1867. General Custer after the battle of Washita had secured possession of Lone Wolf and Satanta and threatened to hang them both unless they consented to bring in their tribe, and this they finally consented to do in the spring of 1869. Lone Wolf, however, continued to maintain an attitude of defiance and in 1872 headed a delegation of his tribesmen to Washington to adjust their difference, but about this time his son and nephew were killed in Mexico while raiding and Lone Wolf immediately set out for Mexico at the head of a small party to secure their bodies and inflict vengeance on their slayers. Upon his return he headed the warlike portion of his tribe in the southern outbreak of 1874, the first battle with the troops taking place at the agency at Anadarko on 22 August. The outbreak was finally quelled by General Mackenzie in the spring of 1875; Lone Wolf, with the other chiefs, one by one, surrendered and were held prisoners at Fort Marion, Fla., from 1875 until May 1878, when those surviving were returned to their tribes.

LONG, Charles Chaillé. See Chaillé-Long, Charles.

LONG, Crawford W., American physician: b. Danielsonville, Madison County, Ga., 1 Nov. 1815; d. Athens, Ga., 16 June 1878. He was graduated from Franklin College, Pa., in 1835, and from the Medical School of the University of Pennsylvania in 1839, and after practising a short time in Jefferson, Ga., removed to Athens, Ga., in 1851. He claimed to have performed on 30 March 1842 the first surgical operation ever made while the patient was unconscious from inhaling ether. This appears to have been done in accordance with careful reasoning upon the subject, but although he repeated the experiment successfully in three other cases not far from that time the facts did not then become generally known. In December 1844 Dr. Horace Wells in Boston demonstrated practically the principle of anæsthesia by the use of nitrous-oxide gas, and in 1846 W. T. G. Morton followed him in a similar discovery and publicly demonstrated the feasibility of employing anæsthetics in surgical operations. In 1902 the Georgia Medical Association proposed to place a statue of Long in the National Capitol as the discoverer of anæsthesia. See Anæsthesia; Morton, W. T. G.; Wells, Horace.

LONG, George, English classical scholar: b. Poulton, Lancashire, 4 Nov. 1800; d. 10 Aug. 1879. He was educated at Macclesfield Grammar School and Trinity College, Cambridge, where he was Craven University scholar in 1821. Three years later he was appointed to the chair of ancient languages at the University of Virginia, but returned to England in 1828 and became first Greek professor at the new University of London. He became professor of Latin at University College in 1842 and from 1846 to 1849 was reader in jurisprudence and civil law at the Middle Temple, and from 1849 to 1871 was classical lecturer at Brighton College. He was one of the founders of the Royal Geographical Society and member of the Society for the Diffusion of Useful Knowledge, for which he edited the *Journal of Education,* also the 'Penny Encyclopedia' and Knight's 'Political Dictionary.' He contributed the articles on law of Smith's 'Dictionary of Greek and Roman Antiquities.' His great claim to fame, however, is as editor of the 'Bibliotheca Classica,' the first critical edition of classical texts with commentaries in English. To it he contributed an edition of Cicero's 'Orations' (1851–62). He also published 'Summary of Herodotus' (1829); editions of ‘Herodotus’ (1830–33), Xenophon's ‘Anabasis’ (1831) and ‘Horace’ (1869); translations of ‘Thoughts of Marcus Aurelius’ (1862), ‘Discourses of Epictetus’ (1877) and ‘Decline of the Roman Republic’ (5 vols., 1864–74). Consult Matthews, H. J., ‘In Memoriam’ (in *Brighton College Magazine*, 1879) and Sandys, J. E., ‘A History of Classical Scholarship’ (Vol. III, New York 1908).

LONG, John Davis, American lawyer and politician: b. Buckfield, Oxford County, Me., 27 Oct. 1838; d. 28 Aug. 1915. He was graduated from Harvard in 1857; taught in Westford Academy for two years; and studied law at Harvard Law School and was admitted to the bar in 1861. He built up a large practice and became senior member of his firm, Long and Hemenway. He was an active member of the Republican party; served in the Massachusetts legislature, 1875–78, being speaker of the house from 1876–78, and was elected lieutenant-governor of the State in 1879; the next year he was elected governor, and re-elected in 1881. He was also for several years on the State house construction commission of the State. In 1883 he was elected to Congress, serving there till 1889; he was then a candidate for the Senate but was defeated, and did not hold public office till appointed Secretary of the Navy by President McKinley in 1897. He held this office through the Spanish War, conducting its affairs with marked ability, and resigned in March 1902. He encouraged an agitation for a larger naval armament. He published in 1879 a translation of the ‘Æneid’ of Virgil; edited ‘The Republican Party: Its History, Principles, and Policies’ (1888); and was part-author of ‘The American Business Encyclopædia and Legal Adviser’ (5 vols., 1913). He wrote ‘The New American Navy’ (2 vols., 1903).

LONG, John Harper, American chemist: b. near Steubenville, Ohio, December 1856. In 1877 he was graduated at the University of Kansas and in 1877–80 he studied at Tübingen, Würzburg and Breslau. Since 1881 he has been professor of chemistry at the Medical School of Northwestern University. From 1913 to 1917 he served as dean of the Northwestern University School of Pharmacy. Professor Long is member of the referee board of consulting experts of the United States Department of Agriculture; member of the revision committee of the United States Pharmacopœia and member of the council on pharmacy and chemistry of the American Medical Association. He was president of the American Chemical Society in 1903–04. His publications are ‘Elements of General Chemistry’ (1898; 4th ed., 1906); ‘Textbook of Analytical Chemistry’ (1898; 3d ed., 1906); ‘Textbook of Urine Analysis’ (1900); ‘Laboratory Manual of Physiological Chemistry’ (1894); ‘The Optical Rotating Power of Organic Substances’ (translated from the German, 1902); ‘Textbook of Physiological Chemistry’ (1905; 2d ed., 1909).

LONG, John Luther, American novelist: b. Pennsylvania, 1861. He read law; was admitted to the bar and engaged in practice at Philadelphia. Meanwhile he began his literary career with ‘Miss Cherry-Blossom of Tokyo’ (1895). His other works are ‘Madame Butterfly’ (1898), dramatized by Belasco, and the inspiration of Puccini's great opera; ‘The Fox-Woman’ (1900); ‘The Prince of Illusion’ (1901); ‘Naughty Nan’ (1902); ‘Little Miss Joy-Sing’ (1902); ‘Sixty Jane’ (1903); ‘Heimweh and Other Stories’ (1905); ‘Billy Boy’ (1906); ‘Felice’ (1908); and the plays. ‘Andrea’ (1904); ‘The Dragon Fly,’ with E. C. Carpenter (1905); ‘Dolce’ (1907); ‘Kassa’ (1910); ‘Baby Grand’ (1912); ‘War — or What Happens When One Loves One's Enemy’ (1913); ‘Lady Betty Martingale’ (1914); ‘Billy Boy’ (1915); cantatas, ‘Yo-Nennen,’ with Mr. Leps (1903); ‘Gar-Anlaf,’ with the same (1905); ‘The Song of Times,’ with Dr. Parker (1911); the operas, ‘Andon,’ with Leps (1904); and ‘Hosni-San,’ with the same (1906).

LONG, Stephen Harriman, American engineer: b. Hopkinton, N. H., 30 Dec. 1784; d. Alton, Ill., 4 Sept. 1864. He was graduated at Dartmouth College in 1809, and after teaching school entered the United States engineer corps in 1814. He taught mathematics at West Point 1814–16, and was subsequently engaged for several years in surveys of the country west of the Mississippi River, as well as of the Upper Mississippi. Long's Peak in the Rocky Mountains was named in his honor. When the construction of the Baltimore and Ohio Railroad was commenced in 1827 Long became chief engineer of surveys and introduced many improvements in wooden bridges, to adapt them for railroad purposes. In the construction of railroads he established a system of curves in locating roads. He served for some years on the board for the improvement of the Mississippi, and in 1856 was placed in charge of that work. He was appointed colonel of engineers in 1863, retiring the same year. His ‘Railroad Manual’ (1829) was the first work of its kind published in the United States. Consult Keating, W. H., ‘Narrative of an Expedition to the Source of St. Peter's River, Lake Winnipeck, Lake of the Woods, etc., Performed in the Year 1823’ (2 vols., London 1825).

LONG, William Joseph, American Congregational clergyman and author: b. North Attleboro, Mass., 3 April 1867. He was graduated from Harvard in 1892 and from the Andover Theological Seminary in 1895. He held a pastorate at Stamford, Conn., 1899–1904, and is at present pastor at large. He has lectured on animal life, literature and nature and made a notable defense of ministerial liberty at the Cambridge Council of 1898. He is the author of ‘The Making of Zimri Bunker’ (1898); ‘Ways of Wood Folk’ (1899); ‘Wilderness Ways’ (1900); ‘Beasts of the Field’ (1901); ‘Fowls of the Air’ (1901); ‘Secrets of the Wood’ (1901); ‘School of the Woods’ (1902); ‘Following the Deer’ (1903); ‘A Little Brother to the Bear’ (1903); ‘Northern Trails’ (1905); ‘Brier Patch Philosophy’ (1906); ‘Whose Home is the Wilderness’ (1907); ‘History of English Literature’ (1909); ‘American Literature’ (1913), and contributions to magazines.

LONG BEACH, Cal., a city in Los Angeles County, situated on the beautiful San Pedro Harbor, directly south of Los Angeles, about 20 miles distant. It is on the Southern

Pacific Railroad and is connected by steamers with Santa Catalina Island. It has an excellent commerce in fruit and produce, as well as lumber, and is also well known as a watering place, having many attractive scenic features and points of interest. Pop. 17,800.

LONG BEACH, N. Y., a seaside resort, 25 miles from New York City, situated on an island just off the coast of Long Island, beyond Rockaway. It has a winter population of 300 and a summer population of 3,000. It is reached by the Long Island Railroad, and has several hotels, many cottages and a fine board walk built on concrete piles and girders.

LONG BRANCH, N. J., city, in Monmouth County, on the Atlantic Ocean, and on the Pennsylvania, the New Jersey Southern and the Central of New Jersey railroads, about 35 miles by water, 45 miles by rail and 30 miles in direct line south of New York City. Long Branch extends four miles on the Atlantic Ocean, with about 5,000 acres of area. During the summer season steamers run regularly several times a day between New York and Long Branch and there are numerous electric and railway lines. The city is governed by the commission plan, composed of five commissioners who choose the mayor from their number. They are elected at large and serve for four years. Assessed property values exceed $16,000,000. There are five banks with a combined capital of $400,000, with deposits of upward of $2,500,000. Long Branch is one of the oldest summer resorts in the United States, taking its name from a brook, a branch of the South Shrewsbury River, which runs in a direct line northward. The Indians had a fishing village here in 1734 and called the place Land's End. Before the Revolution Long Branch was owned by Colonel White, a British officer of New York who had a summer home here. After the war the property was confiscated by the government and in 1788 was taken by Elliston Perot of Philadelphia. Perot was a pioneer landlord on the New Jersey coast and his boarding-house was the forerunner of the multitude of modern hotels. From the beginning Long Branch attracted families from both New York and Philadelphia soon becoming noted as a resort of wealth and fashion. During the administration of President Grant, Long Branch was the summer capital of the United States and became not only the gathering place of the leaders of society but the home as well of the President of the United States, members of the Cabinet and foreign ambassadors. President Garfield sought rest and recreation here and when felled by the assassin's bullet was brought here thinking the benefits of the wonderful atmosphere would restore his health. Its proximity to New York, Philadelphia and other large Eastern cities give it a large transient summer population.

LONG BRIDGE, a bridge connecting the city of Washington, D. C., with Virginia on the opposite bank of the Potomac. It was of supreme importance as a line of communication during the Civil War, and was strongly held by the Union forces.

LONG ISLAND, N. Y., an insular projection which forms the southeasternmost portion of the State and is connected by five bridges and several ferries across East River with Manhattan Island, New York City. It is bounded on the north by Long Island Sound, separating it mainly from the south shore of Connecticut. The Atlantic Ocean bounds it on the east and south, while The Narrows, New York Bay and East River, already mentioned, connecting the ocean with the Sound, complete the boundaries on the west and northwest. Several small islands around the coasts are included in its political boundaries, the best known being Coney, Rikers, Berrian, South Brother, Fire, Barren, Shelter, Gardiner, Fisher and Plum. Long Island has a maximum length of about 118 miles, varies in width from 12 to 23 miles and has an area of 1,682 square miles. It is divided into four counties, Nassau, Suffolk, Queens and Kings, the last two, metropolitan boroughs of New York City, occupying a considerable portion of the western end of the island. Queens County embraces the populous centres of Long Island City (q.v.), Maspeth, Corona, Flushing, Jamaica, Woodhaven and Far Rockaway, while the boundaries of Kings County are those also of the former city, now the metropolitan borough, of Brooklyn (q.v.).

The 280 miles of coast line are indented with numerous bays and inlets. A deep bay, 30 miles long, divided into Great and Little Peconic and Gardiner's bays, splits the eastern end of the island into two long, narrow peninsulas, the southern terminating at Montauk Point, and the northern at Orient Point, with Plum and Fisher's islands extending beyond. Great South Bay, from two to five miles broad, extends along the southern coast for nearly half the length; it is separated from the Atlantic Ocean by Fire Island or Great South Beach, a sandy strip from a quarter of a mile to one mile wide, communicating with the ocean by several openings. Jamaica Bay is on the south coast also, New York Bay on the west, while along the north coast are Flushing, Little Neck, Manhasset, Hempstead, Oyster, Huntington and Smithtown bays. A government system of lighthouses, life-saving stations, fortifications and masked batteries extends around the coast.

The level sea-coast of the south side, with its extended views of bay and the broad ocean, contrasts sharply with the hilly north side and its deep indentations looking out upon the land-locked Sound. The rolling stretches of Montauk Point and Shelter Island afford another contrast to the many square miles of scrub oak and level sandy plains in the centre of the island. The island reaches a height of over 380 feet in West Hill, Suffolk County, and in Harbor Hill at Roslyn, the loftiest points in the range of glacial hills that extends along the northern coast. The island is well watered by several small streams, the Peconic, 15 miles long, flowing into Great Peconic Bay, being the largest. Natural ponds or lakes abound, and there are about 116 square miles of salt marsh throughout the island. The eastern portion especially is well wooded and noted for its pine forests well stocked with deer and other game. Like other insular positions the climate is milder than that of the adjacent continent, the average temperature being several degrees below that of the metropolis, while the hottest days are tempered by cool and refreshing breezes from ocean or Sound. The soil generally is productive and under a high state of cultivation. In the southern flat lands it is of a light, sandy nature, well calculated for raising grain, especially Indian corn; in the hilly north the soil is strong and adapted to the culture of grain, hay and fruits. Market gardening for metropolitan demands constitutes the principal portion of the agricultural industry of Kings and Queens counties. Oyster, clam and other fisheries are important sources of food supply.

The Long Island and other railroads give easy access from New York City to the remotest parts, Montauk Point, the southeasternmost point, being only three hours away. Long Island is noted especially for exceptional opportunities, embracing all sorts of summer recreation. The roadways are admirably adapted to all forms of locomotion, and riding, driving, automobiling and wheeling are equally desirable methods for enjoying the region. In the numerous villages and towns along Jamaica Bay, Great South Bay, Peconic Bay and the Sound, there are ample facilities for sailing, rowing, fishing and bathing, which are fully utilized. For golfing, lawn tennis and all other forms of outdoor sport and recreation, every possible facility is found, and the golf courses, especially at Garden City and Shinnecock, are notable. The chief seaside resorts along the south coast are Bath Beach, Bensonhurst, Coney Island, Brighton, Manhattan, Rockaway Beach, Far Rockaway, Long Beach, Fire Island, Patchogue and Montauk Point; along the north coast are Greenport, Port Jefferson, Coldspring Harbor, Oyster Bay, Glen Cove, Seacliff, College Point and North Beach. The population of Long Island is over 2,000,000; of this number over 1,800,000 reside in Brooklyn borough.

When discovered in 1609 by Hudson, Long Island was inhabited by 13 tribes of Algonquin Indians, by whom the island was variously called Panmancke, Wamponomon, Mautowacks and Sewanhacky. A few descendants mixed with negro blood, and retaining no knowledge of their ancient language, dwell near Montauk Point and Shinnecock Neck. French Protestants from near the river Waal, in the Netherlands, made the first settlement in 1625 under Dutch protection, and immigrants from New England established themselves in different localities shortly afterward. Lange Eylandt, the Dutch name, was changed by the colonial legislature to that of Nassau, a name which survives in one of the counties, but was never adopted by the people for the island. Long Island was a busy base of military movements during the Revolutionary War, and the battle of Long Island (q.v.) is the principal event in its history.

LONG ISLAND, Battle of, one of the early American defeats in the Revolutionary War, was fought 27 Aug. 1776, in Brooklyn, N. Y., mainly within the present limits of Prospect Park, the column in Battle Pass to the memory of the 400 Maryland troops who fell in the battle, and the foundation remains of the redoubt on Lookout Hill, marking the central point of defense and attack. After the evacuation of Boston by the British, Washington made strenuous efforts to fortify New York and its approaches. General Greene, in command of a considerable body of troops, mostly raw recruits, was entrusted with the defense of Long Island, and constructed a line of entrenchments and redoubts from Wallabout Bay to Gowanus Cove. The main works at the Wallabout end were on the hill afterward known as Fort Greene, now marked by Washington Park. At Gowanus Cove, a battery was erected at Red Hook and a fort on Governor's Island, nearly opposite. About two and a half miles from the entrenchments, between them and the southwest side of the island, the range of low hills in this section was then densely wooded and crossed by three roads; one on the right of the works passing near the Narrows to Gravesend Bay, the central one through Flatbush and the third far to the left through Bedford to Jamaica. In the midst of his preparations, General Greene fell ill and the command devolved upon General Sullivan, then just returned from Lake Champlain. Unacquainted with the ground and with Greene's plans the change of command caused considerable confusion. Nine thousand British troops landed in Gravesend Bay on 22 August without resistance; they were commanded by Sir Henry Clinton, assisted by Lords Cornwallis and Percy, General Grant and Sir William Erskine. Lord Cornwallis, rapidly advancing to the central pass, found it occupied by the rifle regiment of Colonel Hand, and without risking an encounter took up a position at Flatbush. Washington inspected the American lines on the 24th and placed General Putnam in command. The following day the British were reinforced by two brigades of Hessian troops, under General De Heister, and on the 26th began to carry out their plan of operations. The road through Bedford to Jamaica unfortunately had been comparatively neglected by the Americans, and eluding the patrol, the British contingent under General Clinton, accompanied by General Howe, the commander-in-chief, and by Lords Percy and Cornwallis, guided by a local Tory, gained possession of the road and neighboring heights undiscovered during the night of 26–27 August. In the morning General Grant, with the left wing of the British army, advanced along the road by Gravesend and the Narrows, and was resisted by Colonel Atlee with a guard of Pennsylvania and New York militia, who retired fighting until he had fallen back upon Gen. William Alexander (Lord Stirling), whose two regiments had hastened to his assistance. Here active firing was kept up by both sides without an attempt at a general action. At the same time, as diversions, De Heister opened up a cannonade from Flatbush upon Colonel Hand and his riflemen, while the guns of the British war-vessels were trained upon the Red Hook battery. Meanwhile on the right Clinton opened his guns upon the Americans, and at this signal De Heister advanced to storm the central pass and the redoubt of which General Sullivan had taken command. The latter, who found his left flank engaged and himself in danger of being surrounded, ordered a retreat, but not soon enough to escape the British light infantry, who drove him back upon De Heister and his Hessians. The Americans fought with desperate valor, a large body cutting their way through the entrenchments, the rest who were not killed either escaping among the hills or surrendering as prisoners, among the latter being General Sullivan. On the left Colonel Atlee and Lord Stirling, who had maintained their position in front of General Grant, found themselves cut off by Cornwallis. They gallantly attacked the enemy with such determination that the British held their ground only by the assistance of reinforcements, when Stirling seeing the uselessness of further resistance surrendered. Having forced all the approaches the British proceeded to invest the American works.

Washington arrived in the evening and took command, the following day bringing over additional troops. But with the formidable British force opposed to him, and indications that the British fleet intended moving up the river so as to cut the force in Brooklyn entirely off, Washington, on the night of 29–30, favored by a thick mist, made a strategic and masterly retreat to Manhattan, greatly to the discomfiture of the British, who were unaware of the movement until some time after the last American had crossed in safety. The Americans lost over 900 men in the battle, while the British loss in killed, wounded and missing was 400. Consult Carrington, H. B., 'Battles of the American Revolution' (Brooklyn 1876); Dawson, H. B., 'Battles of the United States' (New York 1858); Field, T. W., 'Battle of Long Island' (Brooklyn 1869); Johnston, H. P., 'Campaign of 1776 around New York and Brooklyn' (ib. 1878); Rayé-Smith, E. M., 'Battle of Brooklyn' (New York 1913); Mather, F. G., 'The Refugees of 1776 from Long Island to Connecticut' (Albany 1913), and Adams, C. F., 'Battle of Long Island' (in *American Historical Review*, New York 1896).

LONG ISLAND CITY, N. Y., formerly a city in Queens County, but now the first ward of the borough of Queens, city of New York. This section became a part of Greater New York by the Act of Consolidation of January 1898. As early as 1640 Dutch settlers had taken possession of the land in this vicinity and gradually a number of little villages were formed on the western end of the island, on the East River and the Sound. In 1870 a number of little villages, Astoria, Blissville, Dutch Kills, Hunters' Point, Middletown, Ravenswood and Steinway, were united into one municipality and called Long Island City. Newtown Creek separates this section for a distance of four miles from the borough of Brooklyn. It is connected with the borough of Manhattan at 59th street via the Queensboro Bridge, which was opened in 1909; and by the "Queensboro Subway," opened June 1915, to 42d street, Manhattan. The Second avenue elevated extension in New York and the new tunnel under the East River at 60th street will give additional rapid transit connections. The Long Island Railroad and the Pennsylvania Railroad furnish excellent railroad communication, and the New York Connecting Railroad, joining the New Haven and Pennsylvania systems across the bridge at Hell Gate, gives an all-rail route with the mainland. This section has extensive manufacturing interests, excellent schools, several hospitals and churches of all denominations.

LONG ISLAND HISTORICAL SOCIETY, an association founded in 1863 at Brooklyn, N. Y., and having for object the promotion of the study of the history and antiquities of Long Island. It maintains a library of 80,000 volumes, and museum rich in Americana. The Society has published a number of volumes on early American history, including two volumes on the battle of Long Island, a volume of George Washington's letters, town records of Jamaica, L. I., and 'Dankers and Sluyters Voyage to New York in 1679–80.'

LONG ISLAND SOUND, a body of water which separates Long Island, in New York State, from the mainland. It is an arm of the Atlantic Ocean, extending northeast and southwest, about 110 miles long and from 10 to 25 miles wide. It is connected with the Atlantic on the east by The Race, a narrow passage south of Fisher's Island; and on the west by a strait called the East River, which enters New York Bay and through the Narrows to the ocean. The coast on the north is irregular, and has a number of small bays and capes. The south or Long Island coast is irregular from East River to near Port Jefferson; and from Port Jefferson to Orient Point the coast line has few indentations. The largest indentations on the north side are New Haven Harbor and Pelham Bay. There are several good harbors at the mouths of rivers and in places sheltered by small islands. On the south shore the principal indentations are Northport, Oyster, Manhasset, Little Neck and Flushing bays. The north coast is fringed by small rocky islands or reefs. In the western part of the Sound there are a number of small islands, which have been improved so as to be desirable resorts or residential locations. Chief among these are Glen Island and City Island. At the entrance to East River there are a number of islands used chiefly by the health department of New York City. At the east entrance is a group of islands which extend diagonally from Long Island to the State of Rhode Island. The largest of this group is Fisher's Island. (See NEW YORK CITY). The chief rivers which flow into the Sound, all from the north, are Connecticut, Mystic, Thames and Housatonic.

Since the improvements made (1865–85) at Hell Gate (q.v.), Long Island Sound is an available route for ocean steamers. The large passenger steamers which ply daily between New York and New England ports pass through the Sound. A large number of forts with modern equipment are located along the shores, thus guarding most carefully the entrance to New York City by this route.

LONG PARLIAMENT, in English history the fifth Parliament of Charles I, summoned in 1640. Largely liberal and holding tenaciously by its own rights, thanks to the campaigning efforts of John Pym, it declared ship-money illegal, claimed the right of taxation as belonging solely to the Commons and not to the Crown, passed the Triennial Bill, abolished the Star Chamber and the High Commission and, attacking the king's favorites, put Laud in prison and Strafford to death. It also passed an act declaring that it could not be dissolved except by its own consent. In November 1641, passing successfully a reactionary crisis, it adopted the Great Remonstrance, and in January of the next year refused to obey the king's order to surrender "the five members," its leaders, Hampden, Pym, Hollis, Haselrigg and Strode. Thus it brought on the Civil War, through which it continued in power, and was in 1648 "purged" by Colonel Pride of 96 members who, supporting an attempted compromise with the king in 1648, had made themselves obnoxious to the chiefs of the Parliamentary army. The handful of members left composed the «Rump,» which was nominally in power until expelled in 1653 by Cromwell. After the death of Cromwell it was again summoned in 1659, but in October of that year the members were turned out by General Lambert. In 1660 it was again briefly reconvened. See Cromwell.

LONG-TAILED DUCK. See Old Squaw.

LONG-TAILED HUMMER, a humming-bird very common in Jamaica (*Aithurus polytmus*), remarkable for its pair of long crossed tail-feathers. It is also distinguished by a long black crest. It builds a nest of silk cotton, bark, lichen, etc., and covers the outside with spiders' webs.

LONG TOM, (1) the name given a 42-pound gun captured by the British in 1798 from the French battleship *Hoche*. It was afterward purchased by the Americans and used in the attack on Haiti by the French in 1804, and remained idle till 1812, when it was placed on the *General Armstrong*. This vessel ran the British blockade at New Orleans, 9 Sept. 1814, and put into the bay near Horta, Fayal, being disabled in an encounter with a British squadron. Here the gun was dismantled and remained till Colonel Reid, son of the commander of the *General Armstrong,* had it brought back to New York, 18 April 1893. (2) An apparatus for washing gold from the earth or gravel in which it is found. It consists of a wooden trough, from 12 to 25 feet long and about a foot wide. At its lower end it widens and its floor there is of sheet-iron pierced with holes half an inch in diameter, under which is placed a flat box a couple of inches deep. A stream of water is kept running through it by means of a hose; the dirt is shoveled in, and stirred at the lower end, where the earth and gravel fall through the sieve into another box, where they are again sifted. The machine, like the «rocker,» was cheap and wasteful; and both were soon displaced by the sluice.

LONGACRE, James Barton, American engraver: b. Delaware County, Pa., 11 Aug. 1794; d. Philadelphia, 1 Jan. 1869. He was apprenticed in Philadelphia, first attracted attention by his plate of Andrew Jackson after Sully, and in 1819–31 was employed in the illustration of many of the foremost American works then published. At first with James Herring, and later independently, he published the 'National Portrait Gallery of Distinguished Americans' (1834–39), many of whose engravings were from sketches by himself. His portraits are good likenesses, executed with considerable life. Stipple work was his forte but he occasionally turned to line engraving. In 1844 he was appointed engraver to the United States mint, and from that time until his death designed all new coins. He also remodeled the coinage of Chile.

LONGAN, a tree and its fruit. See Litchi.

LONGARD DE LONGGARDE, Dorothea. See Gerard, Dorothea.

LONGCHAMPS, lôn-shŏn, Paris, France, a celebrated racecourse on the southwest side of the Bois de Boulogne, where the race for the «Grand Prix» is run. Prior to its suppression in 1792, part of the site was occupied by the Convent of Longchamps, founded in 1260 by Isabel, sister of Saint Louis. Miracles performed at her tomb caused many princesses to seek the veil there; but in the 16th century it began to lose its sanctity, and in 1652 Saint Francis de Sales protested against the worldly life of its inmates. In 1727 the celebrated opera singer, Mlle. Le Maur, took the veil here. It was a popular resort for carriage driving, especially during the week preceding Easter. The Emperor William I of Germany held a review of troops at Longchamps during the War of 1870.

LONGE, a local name (Vermont) for the lake trout (q.v.).

LONGEVITY. The normal duration of life differs in different species of animals, but what factors determine the length of life of a particular species have not been discovered. Observation has taught a few generalities, that large animals live longer than small ones, that species having a numerous progeny are short-lived, that those that have a long period of gestation live longer than those that have a short period of gestation, etc. Buffon, Fleuron and other naturalists have devised formulæ for estimating the normal duration of life, but none will apply to more than a few species or will apply to man.

To obtain a rational basis for estimating the normal duration of human life we must consider the human being possessing the inherent factors and living under the most favorable conditions necessary to complete the normal cycle of life. Possessing the inherent factors of heredity and sound constitution and living in the proper environment and following a natural mode of living, the normal cycle of life falls naturally into three distinct periods, development, maturity and decline, each lasting about 30 years. That few complete the normal cycle is due in most cases to accidental and avoidable causes, while the few who greatly exceed the normal duration are considered as freaks of nature, comparable to giants in growth. An important factor conducive to longevity is the adaptability of the human organism to diverse environmental and living conditions. Instances of longevity are found in the torrid and frigid zones as well as in the temperate zone, in the smoke-laden atmosphere of manufacturing cities as well as in the clear atmosphere of the plains and mountains, in the ghettoes and slums and in the homes supplied with every known hygienic device. The factor of heredity is dominant as long as there is no change in environment and mode of life. A large proportion of the Jews in the European ghettoes reach old age. Transplanted to the United States and subjected to the same influences that shorten the lives of Americans, they deteriorate and few reach the age of their parents. The same applies to the children of Irish and Russian peasants when they come to this country. The factors especially conducive to longevity, beside the inherent factors of heredity and constitution, are outdoor active life, the activity being gauged by the physical capacity of the individual; coarse, fresh food not in excess of the needs of the body, as indicated by the sense of hunger; immediate attention to the call for the elimination of waste; sleep, the time and amount regulated by the needs of the body without regard to the clock; rational recreations on the principle that the recreation should be the antithesis of the work which made it necessary; freedom from worry and other causes of mental depression. These factors prevail to the greatest extent in the peasant class and in this class is found the largest number and largest proportion of persons who complete the normal cycle of life. The peasant as he grows old gradually adapts his mode of life to the changing physical conditions, he works more slowly, rests more, sleeps longer and takes naps during the day, eats less, and as the mental powers wane he takes a lessened interest in the events of the day and is less affected by cares, worries and excitement. Under the stress of modern commercial and manufacturing activity, especially in the cities, it is becoming more and more difficult to live in such a manner that the factors conducive to longevity can be made available, and consequently premature senility and avoidable causes of disease and death are everywhere becoming more prevalent.

The statistics and records of longevity are notoriously unreliable. Records are either absent or defective. With advancing years the faculty of memory becomes weakened and the mind shows a tendency to exaggeration and the appropriation, through auto-suggestion, of incidents belonging to the lives of others, or the invention of incidents which through frequent telling become so firmly impressed upon the mind as to appear real. Forgetting their exact age they say they are near or about the next semi-decade and in a year or two they will have passed that semi-decade and are near or about the next semi-decade. Having thus reached 90 they say they are near 100, about 100 or have passed the century mark. This explains why the census records show more persons living at the age of 80 than at the age of 79, more at 85 than at 84, more at 90 than at 89, more at 95 than at 94 and many more at 100 or over than at the age of 96, 97, 98 or 99.

According to the Bible man's days shall be 120 years (Gen. vi, 3), but this does not harmonize with the ages of antediluvian Biblical characters. We find however a progressive reduction in ages after the flood. Noah was 950 years old, his son Shem was 600 years old and Shem's son Arphaxad was 438 years old. The first born of the 4th, 5th and 6th generations after Arphaxad were between 230 and 239 years and those who came later were less than 200 years old. Abraham was 175 and Joseph, the third generation after Abraham, was 110 years old. Few later Biblical characters exceeded this age. Moses was 120 years old and Aaron reached the age of 123 but David was only 70 when he was described as being old and stricken in years.

Numerous instances of extreme longevity are recorded by ancient writers but it is impossible to verify them. Pliny records 170 centenarians found in a population of 3,000,000 inhabitants living between the Apennines and the Po, in a tax census taken during the reign of Vespasian. Pliny, Lucian and other writers record ages ranging from 200 to over 800 years. It is possible that under the rigorous regimen then in vogue the weaklings died young and those who survived reached old age but we have no means of verifying those ages. Hippocrates is one of the few notables whose age is suposed to have exceeded 100, yet his biographers give his age variously as 84, 90, 104 and 109 years.

In most modern instances of extreme longevity critical investigation fails to substantiate the reputed age. In the celebrated case of Thomas Parr, the Shropshire peasant who died at the reputed age of 153, and who was buried in Westminster Abbey, critical investigation has virtually disproven the recorded age. In the case of Petraz Czarten, a peasant who died in 1724 in the village of Kapros, Hungary, at the reputed age of 185, there are no records except the statement of his son who was 95 years old at the time of his father's death. In 1797 Joseph Surrington, a Norwegian peasant, died at the reputed age of 160, leaving several children, the oldest claiming to be 103, the youngest 9 years old. A factor which makes the verity of these great ages still more doubtful is the late age at which they are said to have married. Parr is said to have married at the age of 120 years; Drakenburg, a Danish peasant, married at the age of 111 and reached the age of 146, and a number of other centenarians are said to have married in the ninth and tenth decades of life. Gurgen Douglas who married at the age of 85 had eight children, Peter Albrecht had seven children after he married at the age of 85. In these cases the individuals were ignorant peasants, there are no records by which the ages can be verified and the ages given were probably rough guesses made by persons who had no means of determining the real age.

A number of cases of extreme longevity have been reported in the United States but in very few cases has it been possible to verify the ages owing to lack of records. Most cases were those of Indians, negroes and illiterate whites who had no means of knowing their exact age. The tendency to exaggerate is evident from the census reports which show a greater number of persons who give their age as at a semi-decade, 80, 85, 90, 95 or 100, than at a year or two younger. In cases where it has been possible to make a critical investigation exaggeration has almost invariably been found. In the celebrated case of Noah Raby who died in 1904 in Piscatawney almshouse, New Jersey, at the reputed age of 132, the Census Bureau made a critical investigation. No record of his birth could be found. Raby stated that he was in the United States navy in 1809 but the records of the navy showed that Noah Raby was first mentioned in the navy records in 1839. The census records showed that Noah Raby was in the almshouse in 1870, his age then given being 59. This and other incidents of his life that could be verified made his actual age 93 or 94.

The unreliability of longevity statistics is apparent when we consider that the largest number of reputed centenarians are found in countries having a large illiterate population and incomplete records or no records at all. According to the 1910 census there were 3,300 centenarians in Rumania in a population of 8,000,000 and the same number in Bulgaria with half that population. The largest number is reported from Russia. In countries where census and church records are fairly reliable the number of centenarians is small. In France there were 164, in Great Britain there were 94, in Germany there were 76 and in the United States there were only 40 centenarians whose ages could be verified. Statements from ignorant peasants which cannot be verified through reliable data are devoid of scientific value. It is safe to assume, however, that under the unhygienic conditions existing in Rumania, Bulgaria and Russia only the most vigorous survive the vicissitudes of childhood and these have a fair chance to complete the normal cycle of life. In other countries where improved methods of hygiene have been introduced, where the science of medicine has diminished infant mortality and through a better understanding of tuberculosis and other infectious diseases diminished the death rate in early life, more persons reach middle age. After this time, however, the causes for rapid ageing, especially insufficient sleep, improper food, intense excitement and depressing emotions, cause a rapid increase in the death rate and few reach old age. Only a complete revolution in our mode of life, involving a return to the slow, quiet life of the country, and applying to it the advantages of modern sanitary science, gives any hope for an increase of human longevity. See OLD AGE; SENILITY.

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LONGFELLOW, Ernest Wadsworth, American artist: b. Cambridge, Mass., 23 Nov. 1845. He studied under Couture in Paris, and among paintings by him may be named ‘Italian Pines’; ‘Misty Morning’; portrait of his father, Henry W. Longfellow, the poet; ‘Evening on the Nile’; ‘Morning on the Aegean’; ‘Solitude’; ‘The Matterhorn,’ and many pictures of Egypt and a number of portraits. He is a member of the Century Association, New York.

LONGFELLOW, Henry Wadsworth, American poet: b. Portland, Me., 27 Feb. 1807; d. Cambridge, Mass., 24 March 1882. He was the second son of Stephen Longfellow, lawyer and congressman, and Zilpah, daughter of Gen. Peleg Wadsworth — thus coming from excellent stock on both sides. He seems to have combined the best characteristics of both parents and to have passed an ideal kind of childhood in the beautiful seaport town. His disposition was gentle, sympathetic and studious, and his education was such as to bring out his finest qualities. He was encouraged to read the best English poetry and early began to write verses on his own account, doubtless finding in the success of his favorite volume, Irving's ‘Sketch-Book,’ encouragement to believe that a bright future lay in store for American writers.

In 1822 he entered Bowdoin College, of which his father was a trustee. He continued to lead much the same wholesome life he had led at home, avoiding rough sports, showing a chivalrous regard for women, especially his mother, reading and writing poetry, and performing faithfully his academic duties. Some of his poems were published in *The United States Literary Gazette*, of Boston, and brought him in a tiny sum of money besides an amount of notice altogether out of proportion to their merits. He also gave much thought to the choice of a profession, and, rejecting the law and, despite his piety and attachment to his faith, the Unitarian ministry, he fixed his mind upon the calling of a man of letters. His father prudently did not altogether thwart him, and soon another but not alien calling offered itself. He stood so well in his class — of which Nathaniel Hawthorne (q.v.) was a member — that the trustees proposed to him that he should go to Europe to fit himself to be the first incumbent of a chair of modern languages they had determined to establish. Their offer was accepted, and after a few months of study at home he sailed for Havre, landing there on 15 June 1826.

His friend George Ticknor (q.v.) had advised him to get all he could from the systematized scholarship of Germany, but Ticknor was in advance of his fellow-countrymen, and Longfellow wisely followed his own instinct to steep himself in the color and movement and romance of the Old World's life and literature. He was not idle — for in France, Spain, Italy and Germany he cultivated his exceptional linguistic gifts and prepared himself for the main duties of his chair; but the end he proposed to himself was plainly culture, not scholarship. It was Old-World culture and romance that the new world needed, and these Longfellow later showed that he could transmit even better than Irving had done, and much better than his light-hearted contemporary N. P. Willis (q.v.) was to do. Although his popular reputation will always be that of a poet, Longfellow's important place in the history of American literature is partly due to his eminent services as a translator and a transmitter of culture.

Although very young, the traveler made friends everywhere, both with natives and with fellow Americans, and although his precocious Muse was singularly silent for some years, he laid up a valuable stock of poetic impressions. There was a slight hitch with regard to his professorship, but this was overcome and he returned to America in August 1829 and entered upon his duties at Bowdoin. These he fulfilled with great success, acting also as librarian. He translated and edited textbooks for his students, with whom he always stood in friendly relations, he prepared his lectures carefully, he wrote articles for *The North American Review* on topics of foreign literature, and he published, in another magazine, sketches of travel, which were collected in 1835 under the title of ‘Outre-Mer.’ It was a quiet and useful life and one that was rendered still happier by his marriage in September 1831 to Miss Mary Storer Potter, of Portland.

A little over three years later he was invited to succeed Ticknor as Smith professor of modern languages at Harvard, with the intimation that he would do well to spend some months in Germany before beginning his work. He sailed with his wife in April 1835, and spent the summer in Sweden and Denmark, studying the Scandinavian literatures, which were destined to have a strong influence upon his writings. In the autumn Holland was visited, and there at Rotterdam, after a protracted illness, his young wife died. Much affected, Longfellow went to Heidelberg and settled down for study, yielding his bereaved spirit all the more willingly to the influence of German sentiment and the not yet outworn romanticism of the epoch. Then, after some pleasant traveling in Switzerland, he returned home in October 1836.

Two months later found him at work in Cambridge and soon he was established in the famous Craigie House. He devoted himself to his lecturing and to superintending his assistants — foreigners, who gave him not a little trouble. He was no recluse, and enjoyed especially the society of such men as the historian W. H. Prescott (q.v.), Charles Sumner (q.v.), and that "heartiest of Greek professors," as he was called by Dickens, whom Longfellow also knew pleasantly, Cornelius C. Felton (q.v.). Soon he resumed his long-abandoned habit of writing verses, and after gaining popularity in the magazines through such pieces as 'The Psalm of Life,' he issued his first volume of poems, 'Voices of the Night,' late in 1839. It made an instant appeal, partly through its sound, moral didacticism, partly through its sentiment and its melody, both of which had been in considerable measure derived from Longfellow's study of German poetry. Earlier in the same year he had published a prose work equally or more indebted to German literature —'Hyperion, a Romance,' which was also very popular. This idealized record of his foreign experiences and the later prose tale of New England village life, 'Kavanagh' (1849), have long since ceased to hold the majority of readers, but 'Hyperion' was very important in his work as a transmitter of Old World culture. Late in 1841 his second volume of verse, 'Ballads and Other Poems,' with such moving pieces as 'The Wreck of the Hesperus' secured him in his position as the most popular of American poets — the singer whose songs have gone straightest to the largest number of hearts. There is evidence that he deliberately sought to move the people's feelings, and never was conscious literary effort more thoroughly successful.

In 1842 he paid a third visit to Europe, forming his memorable friendship with the German poet Freiligrath and getting the inspiration for such poems as 'The Belfry of Bruges.' While sailing back he wrote his 'Poems on Slavery,' published late in the year. His gentle nature did not fit him to be a militant poet like Whittier, but his slave lyrics were effective through their sincerity and their metrical and descriptive power.

In July 1843, he married Miss Frances Elizabeth Appleton, of Boston, a beautiful, cultured and wealthy young woman whom he had met on his second visit to Europe and had portrayed as Mary Ashburton in 'Hyperion.' She bore him children, made his home a hospitable centre and ministered to him in an ideal way until her tragic death. The next 17 years formed a period of quiet work and maturing fame. His drama 'The Spanish Student' (1843) was a failure, but 'The Poets and Poetry of Europe' (1845) and 'The Belfry of Bruges and Other Poems' (1846) did him credit, and the beautiful idyll 'Evangeline' (1847) not only won all hearts, but enabled his admirers to proclaim him as an American poet who had succeeded in a fairly elaborate work of art. The not yet naturalized hexameters and the bookish origin of the descriptions have not effectively counteracted the narrative power and the pathos of the story, and 'Evangeline' seems destined to hold its own with readers yet unborn.

Longfellow had already planned a still more elaborate work on which he labored for many years, but which he was never able to make a success. This was 'Christus, a Mystery,' finally completed in 1872, a poem designed to picture Christendom in the apostolic, the mediæval and the modern periods. The second portion, 'The Golden Legend' (1851), was the part first published and was by far the best. Its pictures of mediæval life have deservedly won high praise, but the general public has remained singularly cold to the merits of the work.

Meanwhile, the duties of his professorship, little onerous though they seem to have been, weighed more and more heavily on Longfellow, who was also troubled with weak eyes, frequent attacks of neuraligia and the importunities of autograph hunters and other bores. In 1854 he resigned his chair and thenceforth devoted himself entirely to literary work and pleasant social life. His Indian epic 'Hiawatha' (1855), written in the trochaic measure of the Finnish 'Kalevala,' was immediately popular, and three years later in 'The Courtship of Miles Standish,' he reached his highest point as a narrative poet. Excellent though 'Evangeline,' 'The Golden Legend' and 'Hiawatha' had been, they had, nevertheless, been too plainly the work of a sophisticated poet writing in his library; 'Miles Standish,' dealing as it did with the past of Longfellow's native New England, drew part of its inspiration from the poet's own life and character, molded as they were by tradition and environment.

During the agitated period which immediately preceded the Civil War Longfellow sympathized with the cause represented by his friend Sumner, but took no active part in the strife. In July 1861 the tragedy of his life came to him late — his wife was burned to death, her light dress having caught fire from a match on the floor. He was practically heart-broken, but bore his bereavement manfully. Taking up a task that had long before interested him, he sought solace in translating the great poem of Dante. With the aid of Lowell and Prof. Charles Eliot Norton (q.v.) he completed the work in about five years (published 1867-70). It ranks with the best of such renderings of great poems into English, though some have questioned whether Longfellow was not more successful in his earlier attempts to translate a poet always dear to him.

Meanwhile, in 1863, he had published his 'Tales of a Wayside Inn,' some portions of which, such as 'The Saga of King Olaf,' were excellent. In 1868 'The New England Tragedies,' the final section of 'Christus,' failed to attract readers, as did also the first section, 'The Divine Tragedy,' which appeared in 1871. In the spring of 1868 he sailed for the last time to Europe and remained over a year, receiving degrees from Oxford and Cambridge and other evidences of the affection and admiration his works had gained for him abroad. The rest of his life was marked only by the appearance of an occasional volume, and by a growing veneration among his countrymen for his character and his genius. Probably the most significant productions of his old age were some of his sonnets and his dignified 'Morituri Salutamus,' delivered at Bowdoin (in 1875) at the semi-centennial of his class. He lived on, declining in health but still preserving the serenity of his disposition, until 24 March 1882, when he died after a short illness. Two years later his bust was placed in the Poets' Corner of Westminster Abbey — for his fame was almost as truly a British as an American possession.

Longfellow is generally admitted to be the most popular of American poets, and the celebration of his centenary showed that there has been no real abatement of his countrymen's regard for his character and his works. Naturally, however, he has not escaped censure on the score of the comparatively derivative and facile quality of his genius. Authors of greater individuality, of finer artistic powers and training, of more pronounced national and democratic qualities — Emerson, Poe, Hawthorne, Whitman, for example,— have received higher praise from critics and have aroused in their devotees a more perfervid admiration than has fallen to Longfellow's lot, at least of late years. Waiving comparisons, we may frankly admit that Longfellow did follow, in the main, well-beaten paths, that he was much indebted to the culture of other nations, that he fell short of the higher reaches of the art of poetry, that a considerable proportion of his work is of but slight value. On the other hand, we should insist that nearly all his work, whether in prose or verse, was important in the development of American literature and the American character, that within his limits he was a true and very accomplished artist, that he succeeded in both elaborate and unelaborate forms, that his fame transcended the bounds of his own language, and that, as a narrative poet and a writer of appealing lyrics of sentiment and reflection, he has left a body of work of permanent and individual value. It seems to be hypercritical not to allow the author of 'Flowers,' 'The Building of the Ship,' 'The Bridge,' 'The Day is Done,' and scores of similar lyrics, of such sonnets as the beautiful 'Cross of Snow' (in memory of his second wife), and of such sustained poems as 'Evangeline,' 'The Golden Legend,' 'Hiawatha' and 'The Courtship of Miles Standish,' the ungrudging praise due to the poet who is both great and essentially good and wholesome.

Longfellow's more important publications have already been named, but to them may be added 'The Seaside and the Fireside' (1850), which contained 'The Building of the Ship'; 'Flower-de-Luce' (1867); 'Aftermath' (1874); 'The Masque of Pandora and Other Poems' (1875), which included 'Morituri Salutamus'; 'Kéramos and Other Poems' (1878); 'Ultima Thule' (1880); 'In the Harbor' (1882); and 'Michael Angelo' (1883). For bibliography see Foley's 'American Authors' and the appendix to E. S. Robertson's memoir in the 'Great Writers' series. A very useful list of authorities is given in C. H. Page's 'Chief American Poets,' pp. 641–642. See EVANGELINE; HIAWATHA; TALES OF A WAYSIDE INN.

Bibliography.— There are good editions of the complete works (e.g., the Riverside in 11 vols., Boston 1886–90), and of the poems (e.g., Cambridge, 1 vol.). The standard biography is that by Samuel Longfellow (3 vols., Boston 1891 — superseding the 'Life,' 2 vols., and 'Final Memorials'). An excellent brief sketch is that by G. R. Carpenter in the 'Beacon Biographies' (Boston 1901). The volume in the 'American Men of Letters' is by Col. T. W. Higginson. Consult also W. D. Howells. 'My Literary Friends,' (New York 1900), and Charles Eliot Norton's 'Longfellow' (Boston 1907 — with poems of an autobiographical character); Robertson in the 'Great Writers Series' (London 1887); Wendell, 'Literary History of America' (New York 1900); Bliss, Perry, 'The Centenary of Longfellow' (Boston 1908); Livingston, L. S., 'Bibliography of the First Editions in Book Form of the Writings of Henry Wadsworth Longfellow' (New York 1908). For criticism consult Stedman's 'Poets of America' (New York 1885), and the histories of American literature.

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LONGFELLOW, Samuel, American Unitarian clergyman and poet: b. Portland, Me., 18 June 1819; d. Cape Elizabeth, Me., 3 Oct. 1892. He was a younger brother of H. W. Longfellow, and was graduated from Harvard in 1839 and from Harvard Divinity School in 1846. After his ordination to the ministry he was pastor of the Unitarian church at Fall River, Mass., 1848–51; of the Second Unitarian Church in Brooklyn, N. Y., 1853–60; and of the Unitarian church at Germantown, Philadelphia, 1877–82. His remaining years were spent in Cambridge. His fame as a poet has been overshadowed by that of his brother, but he had a very distinct poetic gift, and his hymns, of which he wrote many, are among the best of modern religious lyrics. He wrote a number of essays for the *Radical*, 1866–71. His published works include 'A Book of Hymns,' with S. Johnson (1846), a compilation revised in 1864 as 'Hymns of the Spirit'; 'Thalatta: a Book for the Seaside,' with T. W. Higginson (1853), a verse compilation partly original; 'Life of Henry Wadsworth Longfellow' (1886); 'Final Memorials of Henry Wadsworth Longfellow' (1887); 'Essays and Sermons' (1894); 'Hymns and Verses' (1894). Consult May, Joseph, 'Memoir and Letters of Samuel Longfellow' (Boston 1894).

LONGFELLOW, William Pitt Preble, American architect: b. Portland, Me., 25 Oct. 1836; d. 1913. He was a nephew of Henry W. Longfellow (q.v.), and was graduated from Harvard in 1855. He was assistant architect of the Treasury Department, 1869–72; was a Fellow of the American Society of Architects, and was the original editor of *The American Architect*. In 1881–82 he was adjunct professor of architectural design at the Massachusetts Institute of Technology. He was chairman of the architectural section of the Board of Judges of the World's Columbian Exposition, 1893. He published 'Abstract of Letters on Perspective' (1889); 'Cyclopedia of Architecture in Italy, Greece and the Levant' (1895; new ed., 1903), a work of great value; 'The Column and the Arch' (1899); 'Applied Perspective' (1901).

LONGFORD, Ireland, county-town of Longford County, on the Camlin River, and on the Midland Great Western Railway, 75 miles west northwest of Dublin. It contains the magnificent cathedral of Saint Mel of the diocese of Ardagh, one of the finest ecclesiastical buildings in Ireland. It is also the seat of a Roman Catholic college and has corn mills, a spool factory, brick yards and tanneries. A large trade is carried on in bacon, butter, grain and other farm produce. Early in the 16th century the ancient name of the town *Athfada* was Anglicized Longford. It was chartered in the reign of Charles II and sent two members to Parliament. It lost its representation in 1800. The town government is vested in an urban district council. Pop. 3,760.

LONGICORNES, or **LONG-HORNED BEETLES.** See CERAMBYCIDÆ.

LONGINUS, Cassius, Athenian Neoplatonic philosopher and rhetorician: b. about 213 A.D.; d. Palmyra, Syria, 273 A.D. Greek literature was the principal subject of his studies. He studied the philosophy of the day under Ammonius Sacas at Alexandria, but subsequently became an ardent adherent of the Platonic philosophy and annually celebrated the birthday of its founder by a banquet. He afterward visited the East, and on the invitation of Queen Zenobia went to Palmyra to instruct her in Greek learning and to educate her children. On the death of her husband he was employed by her in the administration of the state, and advised her to throw off the Roman yoke, by which means he was involved in the fate of this queen. For when Zenobia was taken prisoner by the Emperor Aurelian, and could save her life only by betraying her counsellors, Longinus, as the chief of them, was seized and beheaded 273 A.D. He suffered death with all the firmness of a philosopher. He was distinguished by his oratory as well as his statesmanship and love of liberty. He appears to have known Latin and Syriac as well as Greek. The work known as ‹Longinus on the Sublime,› the best piece of literary criticism in the Greek language, was written either by him or by a certain Dionysius Longinus, whose date is the 1st century after Christ. It was edited by Vahlen, and published at Bonn in 1887. (See SUBLIME, THE). Consult Roberts, ‹Longinus on the Sublime› (2d ed., Cambridge 1907).

LONGITUDE. The longitude of a place on the earth is the angle at the pole between the meridian of Greenwich and the meridian passing through the observer's place; or it is the arc of the equator intercepted between these meridians; or, since this arc is measured by the time required for the earth to turn sufficiently to bring the second meridian into the same position held by the first, it is simply the difference of their local times, usually reckoned in hours, minutes and seconds, instead of degrees. Since it is easy for the observer to find his own local time by the methods which have been given, the problem is really this: being at any place, to find the corresponding local time at Greenwich without going there. There are three principal methods of finding longitude.

Finding Longitude by Means of Signals Simultaneously Observable at the Places between which the Difference of Longitude is to be Found.— 1. *A Lunar Eclipse.* When the moon enters the shadow of the earth, the phenomenon is seen at the same moment, no matter where the observer may be. By noting, therefore, his own local time at the moment, and afterward comparing it with the time at which the phenomenon was observed at Greenwich, he will obtain his longitude from Greenwich. 2. *Ecilpses of the satellites of Jupiter* may be used in the same way, with the advantage that they occur very frequently — almost every night, in fact; but the objection to them is that they are not sudden. 3. *The appearance and disappearance of meteors* may be and has been used to determine the difference of longitude between places not more than two or three hundred miles apart, and gives very accurate results. This method is now superseded by the telegraph. 4. *Artificial signals, such as flashes* of powder and rockets, can be used between two stations not too far distant. The difference of longitude between the Black Sea and the Atlantic was determined by means of a chain of signal stations on the mountain tops; so also, the difference of longitude between the eastern and western extremities of the northern boundary of Mexico. This method is now superseded by the telegraph.

Finding Longitude by Regarding the Moon.— Since the moon revolves around the earth once a month, it is continually changing its place among the stars; and as the laws of its motion are now well known, and as the place which it will occupy is predicted for every hour of every Greenwich day three years in advance in the nautical almanac, it is possible to deduce the corresponding Greenwich time by any observation which will determine the place of the moon among the stars. The almanac place, however, is the place at which the moon would be seen by an observer at the centre of the earth, and consequently the actual observations are in most cases complicated with very disagreeable reductions for parallax before they can be made available. 1. *That of Moon Culminations.*— We merely observe with a transit instrument the time when the moon's bright limb crosses the meridian of the place; and immediately after the moon we observe one or more stars with the same instrument, to give us the error of our clock. As the moon is observed on the meridian, its parallax does not affect its right ascension, and accordingly, by a simple reference to the almanac, we can ascertain the Greenwich time at which the moon had the particular right ascension determined by the observation. The method has been very extensively used, and would be an admirable one were it not for the effects of personal equation. 2. *Lunar-Distances.*— At sea it is impossible to observe the moon with a transit instrument, but we can observe its distance from the stars near its path by means of a sextant. The distance observed will not be the same that it would be if the observer were at the centre of the earth, but by a mathematical process called «clearing a lunar» the distance as seen from the centre of the earth can be easily deduced, and compared with the distance given in the almanac. From this the longitude can be determined. 3. *Occultations.*— Occasionally, in its passage through the sky, the moon overruns a star, or «occults» it. The star vanishes instantaneously, and, of course, at the moment of its disappearance the distance from the centre of the moon to the star is precisely equal to the apparent semi-diameter of the moon: we thus have a «lunar-distance» self-measured. Observations of this kind furnish one of the most accurate methods of determining the difference of longitude between widely separated places, the only difficulty arising from the fact that the edge of the moon is not smooth, but more or less mountainous, so that the distance of a star from the moon's centre is not always the same at the moment of its disappearance. 4. In the same way a solar eclipse may be employed by observing the moment when the moon's limb touches that of the sun. This and the preceding methods (the methods of occultation and solar eclipse) do not belong in the same class with the method of lunar eclipse, because the phenomena are not seen at the same instant at different places, but the calculation of longitude depends upon the determination of the moon's place in the sky at the given time, as seen from the earth's centre.

There are still other methods, depending upon measurements of the moon's position by observations of its altitude or azimuth. In all such cases, however, every error of observation entails a vastly greater error in the final results. Lunar methods (excepting occultations) are only used when better ones are unavailable.

Finding Longitude by Mechanical Methods.— 1. *By the Chronometer;* which is simply an accurate watch that has been set to indicate Greenwich time before the ship leaves port. In order to find the longitude by the chronometer, the sailor has to determine its «error» upon local time by an observation of the altitude of the sun when near the prime vertical. If the chronometer indicates true Greenwich time, the error deduced from the observation will be the longitude. Usually, however, the indication of the chronometer face requires correction for the rate and run of the chronometer since leaving port. 2. *The Telegraph.* — When we wish to find the longitude between two stations connected by telegraph, the process is as follows: the observers at both stations proceed to determine their own local time by a series of star observations with the transit instrument. Then, at a time agreed upon, the observer at the first station «switches his clock» into the telegraphic circuit, so that its beats are communicated along the line and received upon the chronograph of the second, or say the Western station. After the Eastern clock has thus sent its signals, it is switched out of the circuit, and the Western observer now switches his clock into the circuit, and its beats are received upon the East chronograph. The operation is closed by another series of star observations. We now have upon each chronograph sheet an accurate comparison of the two clocks, showing the amount by which the Western clock is slow of the Eastern. If the transmission of electric signals were instantaneous, the difference shown upon the two chronograph sheets would exactly agree. Practically, however, there will always be a small discrepancy amounting to twice the time occupied in the transmission of the signals; but, the mean of the two differences will be the true difference of longitude of the places after the proper corrections have been applied. Care must be taken to determine with accuracy and eliminate the personal equations of the observers. See LATITUDE.

LONGLEY, James Wilberforce. Canadian politician: b. Paradise, Nova Scotia, 4 Jan. 1849. He was educated at Acadia College, Nova Scotia, studied law in Halifax and was called to the bar in 1875. He was chief editorial writer for the *Acadian Recorder,* 1873–87, and was managing editor of the Halifax *Morning Chronicle* (1887–91). Since 1882 he has been a member of Nova Scotia Assembly and in 1884–96 was attorney-general and from 1896–1905 was commissioner of Crown lands. He passed in 1890 a bill for the abolition of imprisonment for debt. He was appointed a puisne judge of the Supreme Court of Nova Scotia in 1905. His literary works include 'Socialism: Its Truths and Errors'; 'Canada and Imperial Federation'; and 'Joseph Howe' in the makers of Canada series.

LONGMAN, Mary Evelyn Beatrice, American sculptress: b. Winchester, Ohio, 1874. In 1896–98 she studied at Olivet College, Michigan, and in 1898–1900 studied sculpture at the Art Institute of Chicago, taking her degree with honors in the latter year. For several years after 1901 she was assistant in the studio of Daniel Chester French. At Saint Louis in 1904 she was awarded a silver medal for her 'Victory' and in 1906 won the commission for the bronze doors at the chapel of the United States Naval Academy, Annapolis. She also executed the bronze doors of the Wellesley College Library and the Storey Memorial in the cemetery of Lowell, Mass., Foster Memorial at Middleburg, N. Y., a torso in the Metropolitan Museum, New York, the busts, 'John Stewart Kennedy,' 'Louise' and 'Enigma.' In 1909 she was made an associate National Academician and a member of the American Federation of Arts, the American Numismatic Society, the Municipal Art Society and the National Sculpture Society. Miss Longman was the recipient of silver medals at the Panama-Pacific Exposition, San Francisco, 1915.

LONGOBARDI. See LOMBARDS.

LONGSMANS, London publishers for many years identified with high-class literature. Thomas Longman (1699–1755) was apprenticed to John Osborne, bookseller, Lombard street. Longman bought the business of William Taylor, publisher of 'Robinson Crusoe,' conducted in Paternoster Row, whence he moved in 1726 to the present site. Longman was a shareholder in many important publications, such as Boyle's 'Works,' Ainsworth's 'Latin Dictionary,' Chambers' 'Cyclopedia' and Johnson's 'Dictionary.' His nephew and successor, Thomas Longman (1730–97), published a new edition of Chambers. With Thomas Norton Longman (1771–1842) the firm reached a high degree of literary and commercial prosperity. Lindley Murray's 'Grammar' was published and proved valuable, while the firm had literary connection with Wordsworth, Southey, Coleridge, Scott, Moore (to whom it paid £3,000 for 'Lalla Rookh), Sydney Smith and other leading authors. In 1826 the *Edinburgh Re-*

view became the property of Longmans. The next important members of the firm were Thomas Longman (1804–79), the eldest son of T. N. Longman who issued a beautifully illustrated New Testament, and William Longman (1813–77), the third son, who wrote 'Lectures on the History of England' (1859); 'History of the Life and Times of Edward III' (1869); and 'History of the Three Cathedrals of Saint Paul' (1873). The events of this generation were the publication in succession of Macaulay's 'Lays of Ancient Rome' (1842); 'Essays' (1843); and 'History.' The famous check for £20,000 paid to Macaulay as his share of the profits of the third and fourth volumes for the first few months (1855) is still preserved. The partners of the fifth generation were Thomas Norton Longman and George Henry Longman, sons of Thomas Longman, and Charles James Longman and H. H. Longman, sons of William Longman. One of the earliest ventures of this time was Disraeli's 'Endymion,' for which the author received £10,000. The connection with Lord Beaconsfield had begun in 1870, when they published his 'Lothair.' A magazine — *Longman's* — was also established by the house in 1882, and ceased publication in 1905. In 1890 Longman's took over the business of Rivingtons, an older firm even than their own. In the persons of Thomas Norton Longman, Charles James Longman and Sir Hubert Harry Longman, the family connection with the business is still maintained.

LONG'S PEAK, one of the highest elevations of the Rocky Mountains, in Colorado, about 48 miles northwest of Denver. Its height is 14,271 feet. It was named in honor of Col. Stephen Harriman Long (q.v.).

LONGSPURS, a group of large finches, typically of the genus *Calcarius*, distinguished by the great size of the claw of the hind toe. All are northern birds, frequenting open lands and inclined to form into flocks. The Lapland longspur (*C. lapponicus*) is known throughout the northern parts of Europe and Asia as well as America, and breeds only in the extreme north, coming south of the area of deep snow in winter, but always rare and irregular in the United States. Three other species are restricted to North America, one of which, the chestnut-collared (*L. ornatus*), is well known in the West, as it breeds abundantly on the plains of Dakota and Montana, making its nest on the ground. All are handsome birds, with a mixture of colors, in which black, chestnut, red and buff are conspicuous. Detailed descriptions of all may be found in Dr. E. Coues' 'Birds of the Northwest' (Washington 1874).

LONGSTREET, Augustus Baldwin, son of William Longstreet (q.v.), American jurist and author: b. Augusta, Ga., 22 Sept. 1790; d. Oxford, Miss., 9 Sept. 1870. He was graduated at Yale College in 1813, began the study of law at Litchfield, Conn., and was admitted to practice in Georgia in 1815. In 1821 he represented the county of Greene in the legislature, and in 1822 was made judge of the Superior Court of Ocmulgee circuit. Declining re-election to the bench, he returned to the bar, and was especially distinguished for his efforts and successes in criminal cases. In 1822 he removed to Augusta, Ga., and founded the *Sentinel*. In 1838 he entered the ministry of the Methodist Church, and was president of Emory College 1839–48, then of Centenary College, Louisiana, and subsequently of the University of Mississippi. He resigned this post after six years and became a planter, but in 1857 he became president of South Carolina College, and a few years later resumed his former post at the University of Mississippi. His works include 'Georgia Scenes,' a series of broadly humorous sketches, long popular (1840). He is said to have disowned the second edition (1867) and vainly tried to destroy the first, 'Letters From Georgia to Massachusetts.'

LONGSTREET, James, American soldier: b. in Edgefield district, S. C., 8 Jan. 1821; d. Gainesville, Ga., 2 Jan. 1904. He was graduated at the United States Military Academy in 1842; entered the army as lieutenant of infantry and, after performing duty at various Western posts, served in the Mexican War, in which (at Chapultepec) he was badly wounded and for gallantry in which he received the brevets of captain and major. From 1847 to 1852 he was stationed on the Texas frontier and in 1858 became paymaster with the rank of major. In June 1861, the Civil War having broken out, he resigned from the United States army and entered that of the Confederacy as a brigadier-general. At the first battle of Bull Run (q.v.) he commanded a brigade, and in 1862 was made a major-general. In the retreat before McClellan, during the Peninsular campaign (q.v.), he was in command of Gen. J. E. Johnston's rear guard, and contributed greatly to the safe withdrawal of the main army to Richmond. In the Seven Days' Battles (q.v.) he fought with credit to himself and his division, whose losses were very heavy; and at the second battle of Bull Run (q.v.) he displayed promptness, energy and generalship to which the Confederate victory was largely attributed. He commanded the right wing at Antietam, and at the battle of Fredericksburg (q.v.) had command of the left, repulsing the desperate assault of Burnside's army. After Fredericksburg he was made lieutenant-general, and with that rank commanded one of the three corps of the Confederate army of invasion, known as the Army of Northern Virginia. At the battle of Gettysburg (q.v.) during the second and third days, he commanded the right wing, which sustained the chief burden of the conflict, furnishing the columns that made Pickett's charge. Transferred to the Army of Tennessee, Longstreet arrived on the field in time to save the day at the battle of Chickamauga (q.v.). He next moved unsuccessfully against Burnside at Knoxville (q.v.) and early in 1864 rejoined General Lee in Virginia. Again distinguishing himself in the battles of the Wilderness, he was severely wounded and for some months disabled, but was in command of the first corps of the Army of Northern Virginia during the later months of 1864 and took some further part in active field-service, retaining to the last his distinction as a general and a fighter, and coming out of the war at its close with the respect of the whole country, which has never diminished. After the war he engaged in business as a cotton factor in New Orleans and, having become a Republican in politics, was surveyor of customs at that port, 1869–73. In the same city he was afterward postmaster. He removed to Georgia in 1875; was United States Minister to Turkey, 1880–81; in 1881–84 served as United States marshal of Georgia, and was appointed United States railway commissioner in 1898. He wrote for periodicals, and published ‘From Manassas to Appomattox’ (1896; 2d ed., Philadelphia 1904). Consult Longstreet, Helen D., ‘Lee and Longstreet at High Tide’ (Gainesville, Ga., 1904).

LONGSTREET, William, American inventor: b. New Jersey, 1760; d. Georgia, 1814. He settled in Augusta, Ga., in early life and on 26 Sept. 1790 wrote a letter to Thomas Telfair of Savannah asking his assistance in raising the means to construct a boat to be propelled by steam. This letter was published in the Savannah and Augusta newspapers, but funds were not immediately obtained, though he stated his entire confidence in the success of the scheme. He was subsequently furnished with the necessary means for experiment, and constructed a small model boat, upon a plan very different from Fulton's, which went on the Savannah River against the stream at the rate of five miles an hour. Cotton had previously been ginned by two rollers, not quite one inch in diameter, which caught the fibres, pressed out the seed and delivered the clean cotton on the other side, where it was taken by the ginner's hand, and deposited in a bag attached to his person. Longstreet invented and patented the «breast roller,» moved by horse power, which entirely superseded the old method. The inventor set up two of his gins in Augusta, which were propelled by steam, worked admirably and promised him a fortune. They were, however, destroyed by fire within a week. He next erected a set of steam mills near Saint Mary's, Ga., which were destroyed by the British in an invasion in the War of 1812. These disasters exhausted his resources and discouraged his enterprise, though he was confident that steam would soon supersede all other motive powers.

LONGTON, England, former town of Staffordshire, two miles southeast of Stoke-on-Trent, on the North Staffordshire Railway. It is situated in the potteries district and there are coal and iron mines nearby. Chinaware and earthenware are manufactured in great quantities. It contains the fine recreation ground named Queen's Park. In 1865 Longton was incorporated as a town; in 1910 it became part of the borough of Stoke-on-Trent. Pop. 37,470.

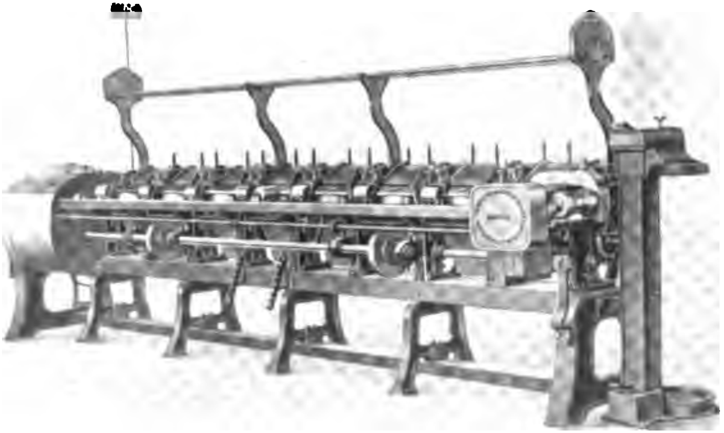
LONGUEUIL, lŏṅ-gėl, Canada, town of Chambly County, in the province of Quebec, on the Saint Lawrence River, and on the Canadian Pacific Railroad. It is situated opposite Hochelaga, the northeastern part of Montreal. Longueuil is a residential suburb of Montreal, and the country around contains many summer homes of city residents. Its industries include the Armstrong-Whitworth steel plant, saw mill and foundry. Pop. 3,972.

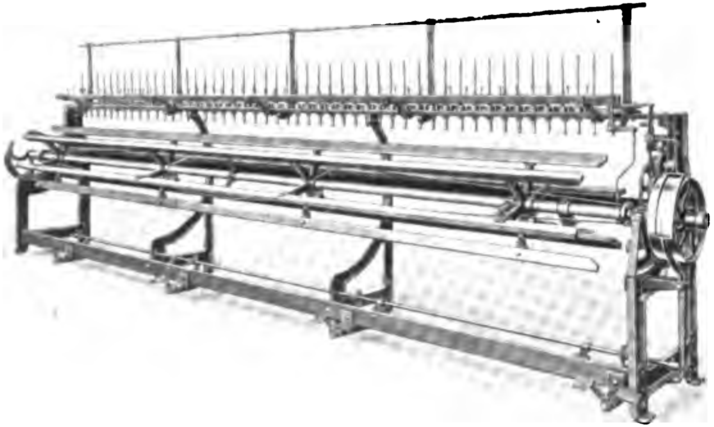
LONGUEVILLE, Anne Geneviève de Bourbon-Condé, ăn zhĕn-vē-ĕv dė boor-bôṅ kŏn-dā lŏṅg-vēl, DUCHESS OF, French beauty and politician: b. Vincennes, 28 Aug. 1619; d. Paris, 15 April 1679. Her father, Henry II, Prince of Condé, was prisoner in the chateau of Vincennes at the time of her birth. Her brothers were the great Condé and the Prince of Conti. The Prince de Joinville, to whom she had been betrothed, having died, she married in 1642 the Duke de Longueville, a widower double her age. Imbibing a fondness for politics, and actuated by hostility to the court and Mazarin, she took an active part in organizing the first Fronde. In order to punish the duchess, her brothers and husband were arrested by order of Anne of Austria, the regent, in 1650; but she persisted in her resistance to the court, and repaired to the citadel of Stenay in Flanders, of which she took the command, and was able to induce Turenne to join the Fronde. After the peace of 1659 she devoted herself to a religious life and her influence in Rome was said to have secured for the Jansenists the so-called peace of Clement IX (1668). The later part of her life was spent in the Carmelite convent of Paris in most stringent observance of religious duties. Cousin, in his ‘Madame de Longueville’ (6th ed., 1859), calls her «the soul of the Fronde.» Consult also Cousin's ‘Youth of M. de Longueville’ (1854); and Williams, H. N., ‘A Princess of Intrigue’ (London 1907).

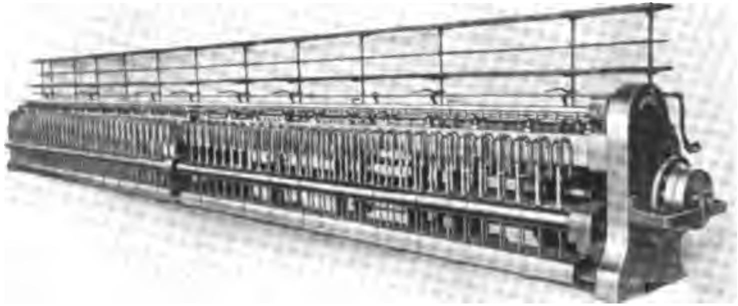
LONGUS, lŏng'ŭs, Greek writer, supposed to have lived about the close of the 4th or the beginning of the 5th century A.D. Concerning his history nothing is known. He was the author of a pastoral romance entitled ‘The Pastorals of Daphnis and Chloe,’ of which the best editions are those of Villoison (1778), Courier (1810), Passow (1811). Longus is the latest of the bucolic poets and in the Renaissance period was widely read, his pastoral descriptions, as given in Amyot's French translation (1559), having not a little to do with the revival of the pastoral form. (See DAPHNIS AND CHLOE). Consult Wolff, ‘Greek Romance in Elizabethan Prose Fiction’ (New York 1912).

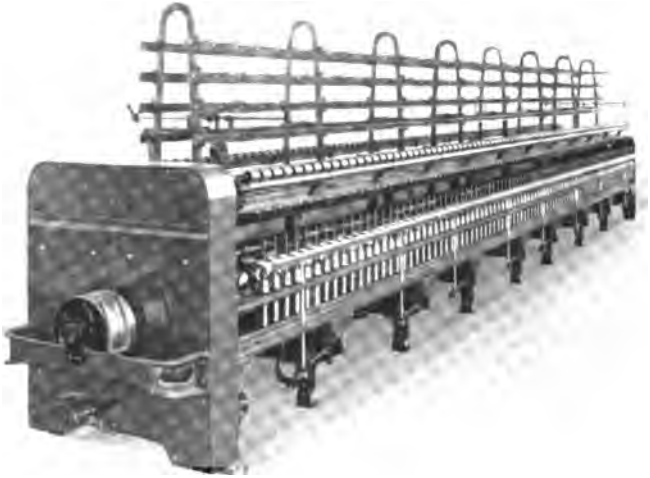
LONGVIEW, Tex., town, county-seat of Gregg County, on the Texas and Pacific, the Texas, the International and Great Northern, and the Texas and Gulf railroads, about 240 miles northeast of Austin and 120 miles east of Dallas. It is situated in an agricultural section, in which are raised large crops of grain and cotton. The chief manufacturing establishments are foundry, lumber mills, railroad shops, cottonseed-oil mills, crate and box factories and plow works. The principal offices of the Texas, Sabine Valley and Northwestern Railroad are in Longview. The trade is principally in agricultural products, livestock, hides, cottonseed-oil and lumber. The waterworks and sewage system are the property of the municipality. Pop. 5,155.

LONGWORTH, Nicholas, American wine manufacturer and horticulturist: b. Newark, N. J., 16 Jan. 1783; d. 1863. At 21 he went to the then unimportant settlement of Cincinnati, where he studied law. After 25 years' experience at the bar he retired from professional life in order to devote himself to the cultivation of the grape, with a view of manufacturing wine. At first his efforts were unsuccessful from his having adopted the erroneous notion of the early American vine growers, that foreign plants were alone to be relied upon. He had imported many different species from every vine-growing country in Europe before trying those indigenous to the United States.

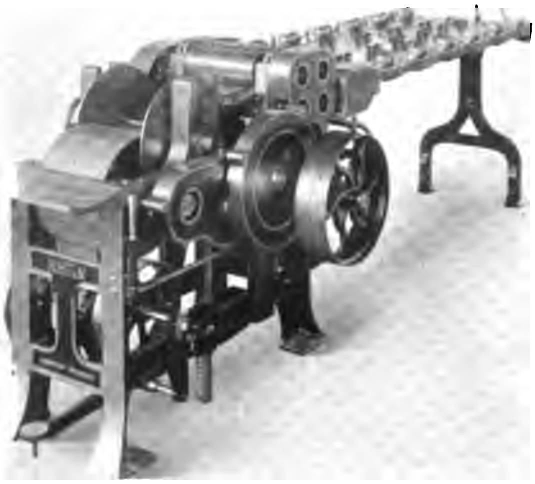


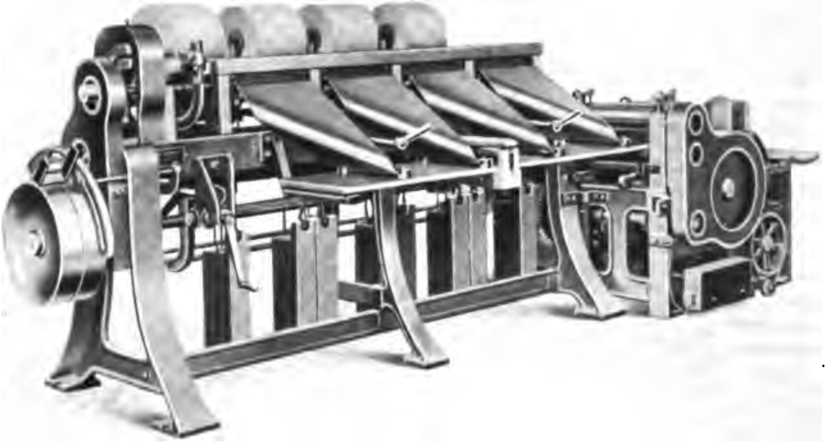


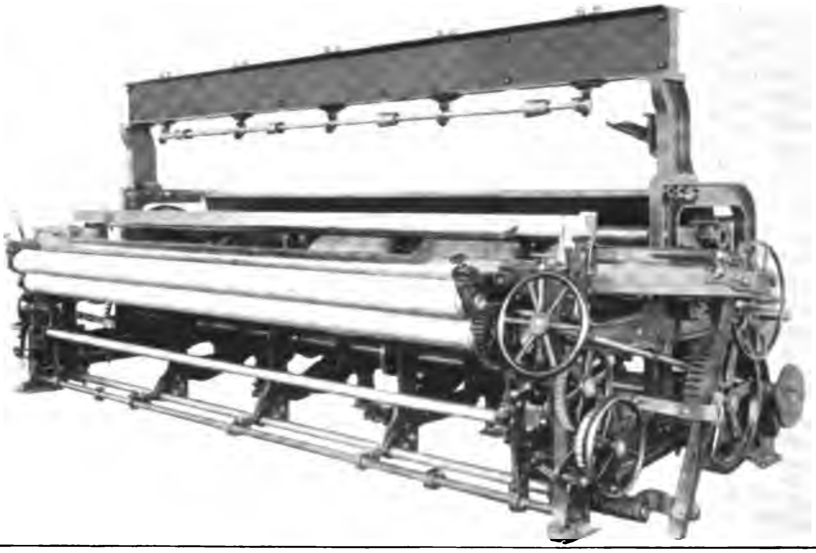




1 Improved Combing Machine (front) 2 Improved Yarn Reel 3 Cotton Roving Frame 4 Twisting Frame with tape-driven Spindles







1 Silver Lap Machine **2 Ribbon Lap Machine** **3 Heavy Duck Loom**

About 1828 he commenced the experiment, and became a high authority in agricultural matters as well as in vine culture, being not infrequently called the «Father of American Grape Culture.» His writings, now obsolete, attained a wide influence in his time.

LONGWY, lŏṅg'vē', France, fortified town in the department of Meurthe-et-Moselle, 90 miles northwest of Nancy, 19 miles southwest of Luxemburg, near the Belgian frontier. It is situated on a plateau, 1,240 feet above the sea, overlooking the Chiers, an affluent of the Meuse. The town comprises an upper and lower town. The former on a hill 390 feet high commands the Luxemburg road and is strongly fortified. The industrial establishments are in the lower tower and include manufactures of iron and steel, jewels, gold and silver ware and porcelain. It has a fine town-hall, built in 1730, a hospital and a 17th century church. Longwy (Longus Vicus) is known as the Iron Gate of France. In 1678 it came into French possession and was fortified by Vauban. The Prussians took it in 1792, 1815 and 1871. In the Great War of 1914–18 Longwy was the first French fortress attacked and although defended with spirit it soon fell to the German invader. Pop. 9,700.

LÖNNROT, lĕn'rŏt, **Elias,** Finnish philologist: b. Sammatti, in Nyland, 9 April 1802; d. there, 19 March 1884. Recognizing the value of the people's songs and ballads for Finnish language study, he spent years — for the most part alone and on foot — in collecting such material in Finland, Lapland and adjoining provinces, and published the fruits of his researches in a series of volumes. Among his «finds» is to be numbered the great popular epic ‹Kalevala,› of which only a few cantos were previously known to the learned world. He wrote a ‹Finnish-Swedish Dictionary› (1866–80). He was professor of the Finnish language and literature at Helsingfors, 1853–62. See Kalevala.

LONS-LE-SAUNIER, lŏṅ-lĕ-sō'nyā, France, town and capital of the Department of Jura, situated on the Vallière, and on the Paris-Lyons Railway, 75 miles northeast of Lyons. It is surrounded by vine-clad hills; contains a 12th century church, law courts, chamber of commerce, lycées, training colleges and a bank. There are salt works in the neighborhood. There is a brisk trade in livestock, cheese, cereals and wood. Wine and leather making are the principal industries. The town was founded by the Gauls, by whom it was called Ledo. The Romans called it Ledo Salinarius. The English burned it in 1364 and it suffered a like fate in 1637 at the hands of the Duke of Longueville. Not until 1674 did it become definitely a part of France. At Lons-le-Saunier Ney and Napoleon met after the latter's return from Elba. It is the birthplace of General Lecourbe, to whom a monument has been erected. There is also a monument to Rouget de l'Isle, author of ‹La Marseillaise,› who was born nearby at Montaigu. Pop. 11,060.

LOO (short for lanterloo, from the Dutch name), a game of cards best played with five (three cards is the more common form), dealt from a whole pack, either by threes and twos, or one at a time. After dealing, a card is turned up for trumps. The jack of clubs, or the jack of the trump suit, as agreed on, is the highest card, styled «pam»; the ace of trumps is next, and then the other cards as in whist. Five cards of a suit, or four with «pam,» compose a «flush,» which sweeps the board, and yields only to a superior flush, or the elder hand. When the ace of trumps is led, it is usual to say, «Pam be civil»; the holder of the jack (of trumps or clubs; see above) is then expected to let the ace pass. Each player has the liberty of changing his cards for others from the pack, or of throwing up the hand, in order to escape being looed, that is, failure to gain a trick. All those that win tricks divide the pool or «loo,» to which on entering the game each player contributes chips (usually three) in proportion to the tricks taken. Every player who is looed must again contribute a stake, which, with the dealer's stake, forms a new pool. At one time the most popular of the round card games, it gave way to «Nap» in England and poker in the United States. Consult Foster's ‹Complete Hoyle› (London 1911).

LOO-CHOO ISLANDS. See Liu-Kiu Islands.

LOOFAH, Egyptian, the fibrous portion of the fruit of one or two species of the genus *Luffa* of the gourd family, sold for use as a bath-sponge or flesh-rubber. There are about 10 species of the genus known, but the «towel gourd,» as this bath-sponge is sometimes called, appears to be obtained chiefly from *L. ægyptiaca.* In the West Indies the fruit of *L. acutangula* yields a similar network of fibres, and is there used as a sponge or dishcloth, and worked up into baskets and small ornamental articles.

LOOKING BACKWARD, 2000–1887, a romance by Edward Bellamy, published in 1888. It had a sale of nearly 400,000 copies in the next 10 years, and is still in demand. It recounts the strange experiences of Julian West, born in 1857, who in 1887 is put into a hypnotic sleep. In the year 2000, Dr. Leete, a retired physician, is conducting excavations in his garden, when West's subterranean chamber is disclosed. The doctor discovers and resuscitates the young man, who finds himself in a regenerated world.

LOOKOUT MOUNTAIN. See Chattanooga, Battle of.

LOOM, a term originally meaning simply «tool,» but now particularized so as to apply to a machine for weaving. The simplest form of the loom, still in use among semi-primitive tribes and up to the middle of the 18th century practically the only form, was the hand loom, a rectangular frame, from one side of which yarn is stretched to the opposite side, where it is so secured that the transverse threads may be passed by hand «over and under» the threads already stretched. Fig. 1 shows the simplest form of this loom. From ancient carvings it appears that this simple loom frame was at first hung vertically from an overhead support, and in all probability was arranged to be lowered as the weaving progressed, so as to keep the work at a convenient level.

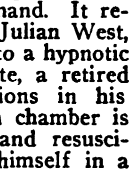


Fig. 1.

So long as the warp lay inert before the weaver it was a very slow process to pick up each alternate thread by hand in order to pass the weft under them. This was overcome from the earliest times by the device of attaching these alternate threads to a staff on which was a loop into which the weaver inserted his great toe and pulled the alternate threads of the warp down together, producing a «shed» below the level of the cloth through which he could throw his shuttle with a single cast. The looseness of the cloth thus woven called for some method of firming it as the weaving proceeded, and at first this was done by lengthening the shuttle so that it was longer than the width of the cloth, and using that to press the newly laid thread or «pick» snugly into the angle or shed of the divided threads of warp. This function was later performed by the «reed» or «sley» — a frame hanging upright, from pivots at the top and filled, at first, with very thin strips of bamboo, but later of fine polished wire. According to the firmness of the cloth to be woven the wires were passed between every two threads of warp, or between every other pair or every other triplet. After each throw of the shuttle the reed is pulled forward, pressing the pick solidly against the newly woven cloth on the cloth roll. When working a wide piece of cloth it was customary to have an assistant at one end to throw the shuttle back to the weaver's end, or if the piece were very wide two shuttle throwers were required, on at each side of the loom.

The first important improvement was the «fly shuttle» invented by John Kay in 1733. This consisted of a pair of shuttle boxes fastened each at one end of a smooth wooden shelf or deck running along the lower part of the reed, and coming close up against the threads of the warp. In each of the shuttle boxes was placed a block of hard wood known as a «picker» strung on a wire, and connected by a cord to a handle immediately above the cloth and in front of the weaver. A sharp pull on the handle would drive the picker against the shuttle with a quick blow and send it flying through the shed. Kay's invention practically revolutionized the weaving industry, as it increased four or five fold the output of a loom fitted with the «fly shuttle,» and rendered assistants unnecessary. He was granted a patent but the weavers everywhere appropriated the device in spite of the patent, and finally mobbed him and drove him to France, where he died in extreme poverty. Nevertheless his invention was a long step forward toward the development of the power loom.

The hand loom for most of the modern textiles has been superseded by the power loom, but for some classes of work it cannot be replaced. It is still in constant use for working out new patterns to be eventually wrought on power looms, and many kinds of high grade fabrics in silks, velvets, fancy cloths and the so-called art fabrics are still made on it.

The accompanying illustration (Fig. 2) shows in a simplified form the essential parts of the hand loom as it existed up to the time of Cartwright's invention of the power loom in 1785. The primitive frame (Fig. 1) occupies a horizontal position in the framework (AAAA), and the former end pieces have become rollers, so that the length of the piece of cloth is no longer necessarily less than the length of the frame. These rollers are the beam or yarn-roll (B), which is at the back of the loom, and upon which the warp threads are wound, and the cloth beam (C) to which the threads are fastened and which winds up the cloth as it is made. The threads of the warp, held tight by weights (b, b) acting upon the yarn-roll to pull it backward, pass through the eyes of the healds, by which they are separated to permit of the passage of the shuttle, and also between the wires of the reed. The shuttle in the hand loom is thrown by the operator, and in the power loom by the picker-staff machinery; in either case it is made of hard wood, is pointed at either end with iron and carries in a recess the quill or bobbin. D shows the hanging batten frame with the reed at the bottom, and the shuttle boxes at each end. At E are the treadles which operate the healds (H) and at G are the points which separate the threads of the warp so that a broken yarn can be quickly identified and mended.

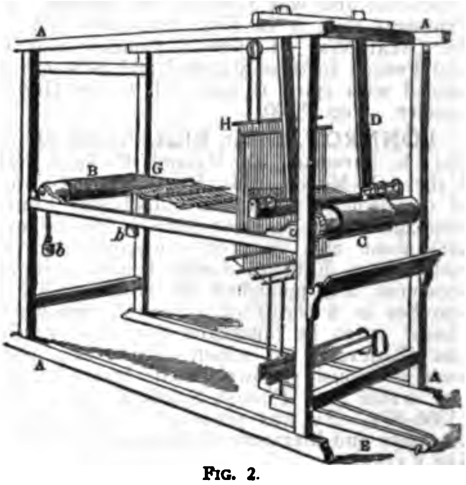
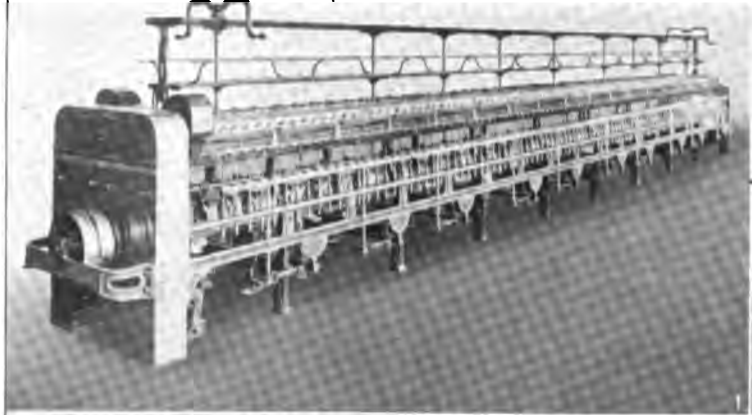
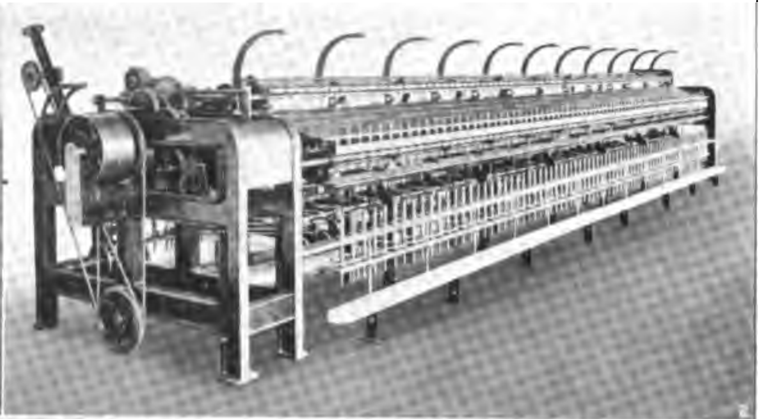
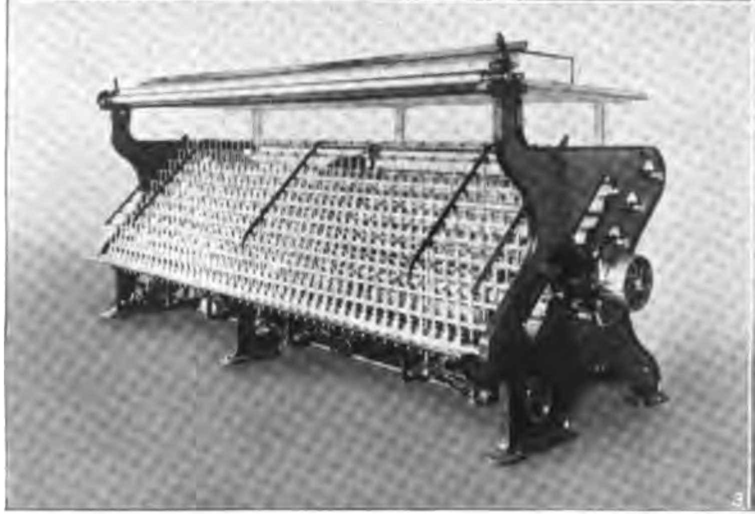


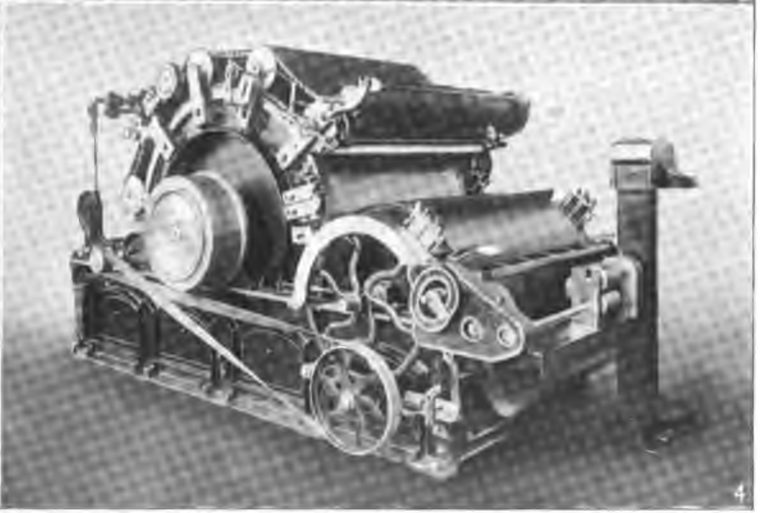
FIG. 2.

This hand loom was first improved, after the unsuccessful attempts of De Gennes in 1678, by Edmund Cartwright, who undertook in 1785 to counterfeit by mechanical means the three simple motions of weaving. He was a clergyman, with neither mechanical nor textile training, but his loom though cumbrous and awkward is essentially that now in use. Dr. Jeffrey, working independently, achieved about the same indifferent results. The first substantial advance was made by Andrew Kinloch in 1793 and William Horrocks added his contribution in overcoming some of the mechanical difficulties. But some minor inadequacies remaining, his loom was quickly superseded by the superior Richard Roberts loom built on the same principles but with greater mechanical skill. The simplest modern loom differs essentially from the hand loom in that the warp yarn is no longer stretched direct from the yarn roll to the cloth beam, and these two parts are no longer placed at the same height from the base of the frame nor at so great a distance as before. The yarn runs upward from the warp-beam over the whip-roll, thence is carried through heald, heddle or (the American term) harness, and through the reed, and down from the latter to the cloth roll. The advantage of



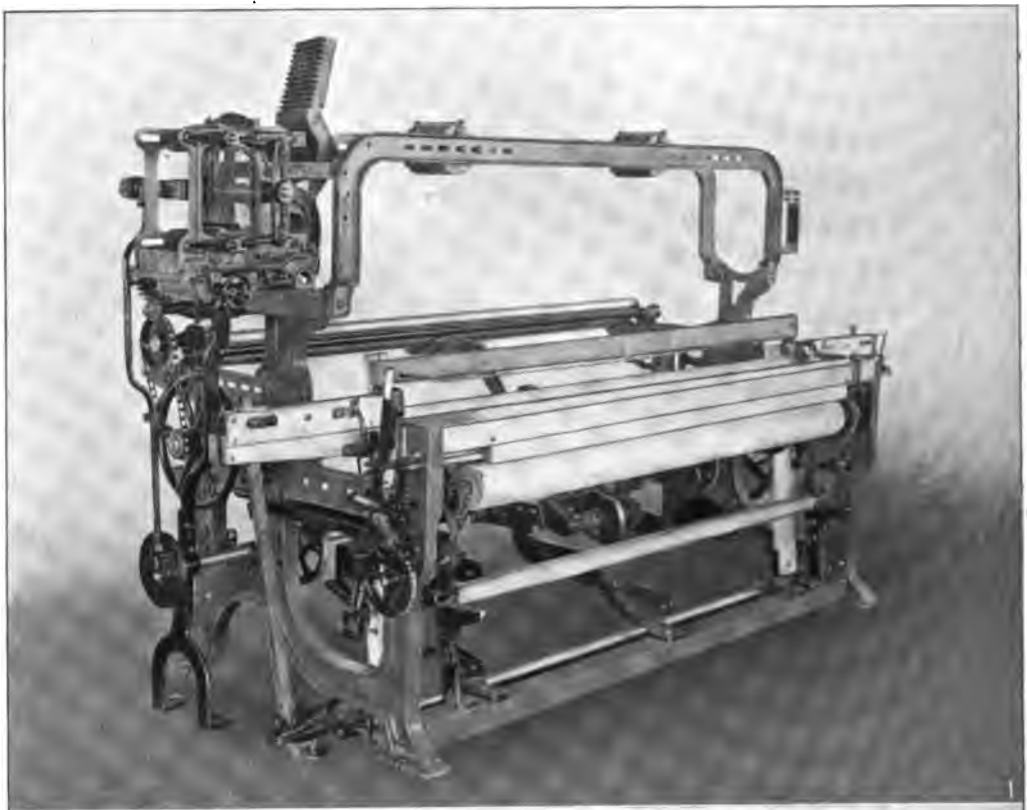


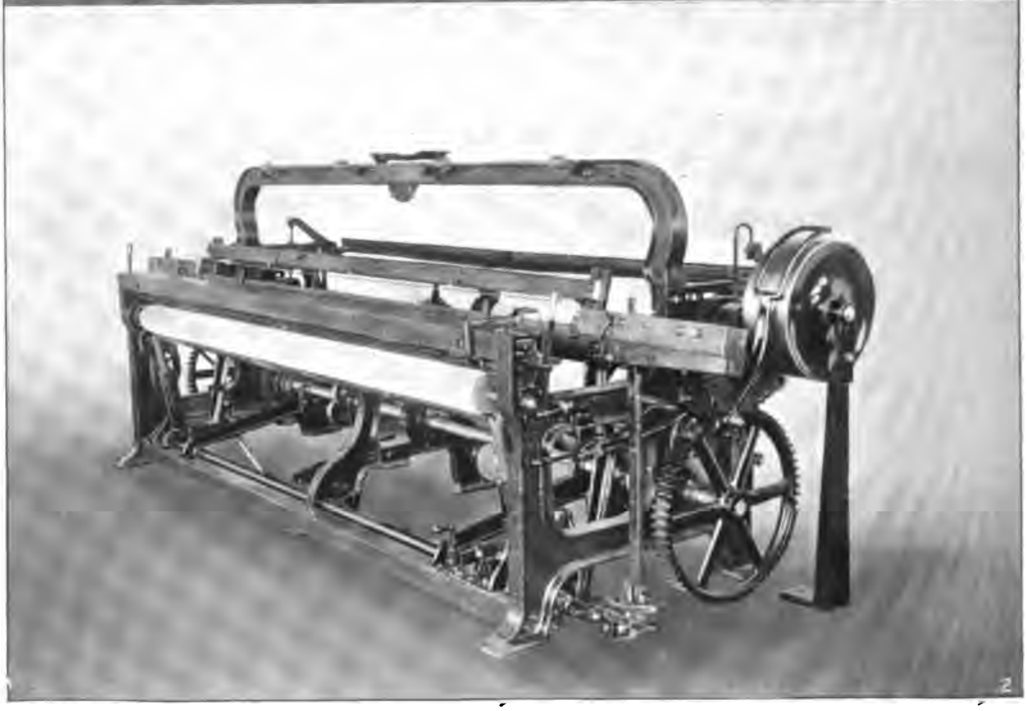




1 Tape Drive Spinning Frame 2 Wool Spinning Frame 3 Quiller 4 Revolving Flat Card

LOOM





1 Dobby Loom

2 Wide Loom

this arrangement is greater stability and a distinct saving in space, the depth of the loom being materially decreased. The ordinary power loom has no mechanical device for renewing the weft as it is used. The ordinary bobbin will run in a power loom for not more than four to six minutes — depending upon the fineness of the yarn. Then the loom must be stopped and a new bobbin put in. Two methods have been adopted to overcome this difficulty: changing the shuttle, as in the Harriman loom, and changing the bobbin, as in the Northrop loom. In practice it has been found that at the speed the loom is usually run, changing the shuttle takes too much time, and the loom has to be slowed down to a standstill. This is accomplished automatically, the shuttle changed and the loom started again. The other method has been even more effective, and the necessary mechanism quite simple. At the proper moment the loom sets in operation a lever which pushes a fresh bobbin from a magazine into the shuttle at the moment it lies stationary in the shuttle box, and the same movement releases a catch and the empty spindle drops out.

With the old-fashioned heddle only the simplest and most regular webs could be woven, the number of heddles being limited to six. The demand for a greater variety in color, pattern and texture led to the invention of the dobby, a lever operated by a projecting pin which engages in the pattern chain. The dobby is not operated alone but in a series, or «battery,» ranging in number from 10 up to 25. Each dobby works a harness connecting with a certain set of warp threads in forming the shed, and the more dobbies on the loom the greater variety possible in the fabric. For highly ornate and figured patterns the most effective mechanism is the Jacquard attachment, patented by a weaver of Lyons, Joseph Marie Jacquard, in 1801. This machine lends itself readily to use with any loom. It may be described as a means of controlling the shed. A revolving prism or «cylinder» is so perforated as to receive certain selected needles, which in turn govern a set of perpendicular hooks. These hooks lift or depress the threads of the warp, so that the weaving is no longer of necessity simply «under or over.» How many threads are to be skipped is determined by a perforated card-board, the perforations occurring where the thread of the warp is to lie above the weft; but if the warp-threads are not to be raised no holes are cut in the cards, the needles do not enter the cylinder and the hook attached to the needle does not lift (by means of its neck-cord or loop of twine), the thread of the warp. A connected series of these cards, each with different perforations, makes an almost infinite combination of patterns possible, as each card makes a different shed. As each card represents a single pick, a series for an intricate pattern is very large, reaching sometimes 30,000 cards.

The hand loom is still used for the manufacture of rugs and fine carpets, but the power loom, driven by various powers, electricity being the latest and in some ways the most economical, is used for almost any purpose. The ribbon loom, for instance, weaves simultaneously a number of narrow pieces. Many attachments, invented in a long series, have continuously and wonderfully decreased the need of any supervision of the loom, making it more and more automatic: thus a shuttle protector automatically stops the machinery if the shuttle fails to fly all the way across the warp; the filling stop motion protects the machinery from running on uselessly when the filling breaks or runs out; and take-up, let-off and warp-stop motions are further automatic devices. A very ingenious machine known as the Chernack circular loom is used in weaving tubular fabrics such as constitute the basis of fire-hose. This loom resembles in appearance a knitting machine. Its shuttle travels around the circuit of upright needles in a circular track being propelled by a pinching movement of the rising and falling needles, in a fashion similar to jumping a fresh apple seed with the pressure of thumb and finger. This loom is used also for weaving wire.

Consult Ainley, A., ‹Woolen and Worsted Loomfixing› (Lawrence, Mass., 1900); The Draper Company, ‹Labor-Saving Looms› (Hopedale, Mass., 1907); International Library of Technology (Vol. LXXX, Scranton, Pa., 1905); Murphy, W. S., ‹Textile Industries› (Vol. IV, New York 1912); Posselt, E. A., ‹Manufacture of Narrow Woven Fabrics› (Philadelphia 1916).

LOOMIS, Alfred Lebbeus, American physician: b. Bennington, Vt., in 1833; d. 23 Jan. 1895. He was graduated at Union College in 1851, and studied medicine in New York City at the College of Physicians and Surgeons, where he was graduated in 1852. He gave his attention to diseases of the lungs at a time when auscultation and percussion were acquiring great scientific importance in medical practice, and in the treatment of such diseases became an efficient specialist. In 1859 he was appointed visiting physician to Bellevue Hospital, New York, and was made lecturer on physical diagnosis at the College of Physicians and Surgeons in 1862. Having spent some months in the Adirondack Mountains for the improvement of his health, in later years he established the Sanitarium at Saranac and the Hospital for Consumptives at Liberty, N. Y. In 1866 he accepted the professorship of theory and practice of medicine at the University of the City of New York, remaining in connection with that institution until his death. The work done by him for its medical department was of great and lasting importance, as were also the services he rendered to the New York Academy of Medicine. In 1874 he was appointed visiting physician to Mount Sinai Hospital; was president of the New York Academy of Medicine, 1889–90 and 1891–92. His publications include ‹Lessons in Physical Diagnosis› (1870); ‹Lectures on Fevers› (1877); and ‹A Text-book of Practical Medicine› (1884). He also edited ‹An American System of Medicine› (1894).

LOOMIS, Charles Battell, American humorist: b. Brooklyn, N. Y., 16 Sept. 1861; d. 1911. He was educated at the Brooklyn Polytechnic Institute and held a business clerkship 1879–91, which he resigned to devote himself to the writing of humorous sketches. He was a frequent contributor to periodicals and published ‹Just Rhymes› (1899); ‹The Four-Masted Cat-boat› (1899); ‹Yankee Enchantments›

(1900); ‹A Partnership in Magic› (1903); ‹Cheerful Americans› (1903); ‹More Cheerful Americans› (1904); ‹I've Been Thinking› (1905); ‹Minerva's Manœuvres› (1905); ‹Cheer Up› (1906); ‹A Bath in an English Tub› (1907); ‹Poe's «Raven» in an Elevator› (1907); a third edition of ‹More Cheerful Americans, The Knack of It› (1908); ‹A Holiday Touch› (1908); ‹Just Irish› (1909).

LOOMIS, Chester, American painter: b. near Syracuse, N. Y., 18 Oct. 1852. He was educated at Cornell University (1868–71); studied painting at Paris under Léon Bonnat, and after a residence of 11 years in France opened a studio at Englewood, N. J. He is favorably known as a figure, portrait and landscape painter and his pictures are found in many private collections. His ‹Christopher Sly› was purchased by the Indianapolis Art Association. His ‹Normandy Milkmaid› was awarded a gold medal at the Massachusetts Charitable and Mechanics' Institution Exhibition. Of recent years he has turned his attention more to portrait and mural painting than to the production of genre pictures and landscape. He is an associate member of the National Academy of Design, and member of the National Society of Mural Painters, the Architectural League, the Artists' Fund Society and the National Arts Club.

LOOMIS, Elias, American physicist: b. Willington, Conn., 7 Aug. 1811; d. New Haven, Conn., 15 Aug. 1899. He was graduated at Yale College in 1830, and was tutor there in 1833–36. He was the first person in America to obtain a view of Halley's comet, at its return in August 1835, and his observations on that body, with a computation of its orbit, were published in the *American Journal of Science.* After a year's study in Paris he was professor (1837–44) of mathematics in Western Reserve College, Ohio, of natural philosophy (1844–60) in the University of New York, and of natural philosophy and astronomy (from 1860) at Yale. He devoted much of his time to original research, wrote more than 100 scientific treatises and published a series of textbooks on mathematics, natural philosophy, astronomy and meteorology, of which more than 500,000 copies were sold; they included ‹Elements of Algebra›; ‹Elements of Geometry and Conic Sections›; ‹Recent Progress in Astronomy.›

LOOMIS, Francis B., American journalist and diplomatist: b. Marietta, Ohio, 27 July 1861. He was a graduate from Marietta College and in 1883 joined the staff of the New York *Tribune.* He was State librarian of Ohio 1885–87; consul at Saint Etienne, France, 1890–93, and editor-in-chief of the Cincinnati *Daily Tribune* 1893–96. He was United States Envoy-Extraordinary and Minister Plenipotentiary to Venezuela, 1897–1901, and while there was active in promoting the interests of American commerce in South America. His successor, H. W. Bowen, charged that Loomis had carried on improper business transactions while in Venezuela, but these charges were dismissed by President Roosevelt. He filled the same diplomatic position at the court of Portugal 1901–02, and became Assistant Secretary of State in January 1902, resigned in 1905. He was designated as special Ambassador to France in 1905 to receive the remains of John Paul Jones, was special envoy to Japan in 1908, commissioner-general to the Tokio Exposition 1911, and to the Exposition at Turin in 1912. He was made grand officer of the Legion of Honor, France, 1904, and has received decorations from the emperor of Japan and the king of Italy.

LOOMIS, Gustavus, American soldier: b. Thetford, Vt., 1789; d. 1872. He was graduated at West Point and received his commission as sub-lieutenant of artillery in 1811. He saw service on the Niagara frontier from 1812 to 1813, in which latter year he took part in the capture of Fort George (27 May) and was made prisoner the following December at Fort Niagara. During the war with Great Britain, the Black Hawk War and the campaign against the Seminole Indians, he held important commands, and after the Civil War, in which he served as superintendent of the general recruiting service, was retired with rank as colonel of infantry. In 1865 he received the brevet of brigadier-general of the United States army.

LOOMIS, Silas Laurence, American scientist and inventor: b. Coventry, Conn., 1822; d. 1896. He was graduated from Wesleyan University in 1844, from the Medical School of Georgetown University in 1856 and was professor of physiology at Georgetown in 1859–60. In 1857 he was appointed astronomer to the United States Coast Survey, in 1860 instructor in mathematics to naval cadets, in 1861–67 was professor of chemistry and toxicology at Georgetown, and subsequently occupied a chair at Howard. Among his inventions are a process for manufacturing a textile fabric from the palmetto, and another for making profitable use of chromium ores. He wrote textbooks of arithmetic, a ‹Key to the Normal Course› (1867); ‹The Education and Health of Woman› (1882), and other works.

LOON, lō-ōn', Philippines, a pueblo of the province of Bohol, situated on the west coast 13 miles north of Tagbiliram, and opposite Dalaguete, Cebu. A mole 328 feet long, protecting the harbor, extends to the town, which is reached by steps cut in the rock. It is picturesquely situated on the slope of the Cammanoc hills and has an old Spanish fort with bastions. It is centrally located for trade, and is the largest town in the province. Pop. 15,400.

LOON. See Diver.

LOOS, lōs, **Charles Louis,** American educator: b. Woerth-sur-Sauer, Basse-Alsace, France, 23 Dec. 1823; d. 1912. He came to the United States in 1832, and settled at New Franklin, Ohio, where he studied English. He was graduated from Bethany College in 1846, where he was professor of ancient languages 1858–80. He was president of Kentucky University 1880–97. In 1849 he was ordained to the ministry of the Disciples and was of great prominence in his denomination. He held pastorates at Wellsburg, Va., Somerset, Pa., and Cincinnati, Ohio.

LOOSESTRIFE, a plant of the genus *Lysimachia,* of the primrose family, about 40 species of which grow in the temperate zones. Several yellow-flowered species belong to the United States, but those best known are the whorled or four-leaved, *L. quadrifolia,* and the bulb-bearing, *L. terrestris*. Two or three species, especially *L. nummularia*, popularly known as moneywort, creeping Charley and creeping Jenny, have been introduced from Europe. One kind is eaten in India as a pot-herb with fish. "Again and again," says Miss Lounsberry, in her 'Southern Wild Flowers and Trees,' "we come across the loosestrifes during our summer and early autumn rambles. And soon we learn to associate with them their opposite, or whorled, leaves, always entire, and their upright, rather stiff manner of growth, and very frequently we look for their petals to be darkly spotted near the bases. In personality the genus reminds us somewhat of the St. John's-wort, but we think of the latter as being usually freer, more prolific bloomers. The old and pretty legend concerning our present plants is that they loose strife; that they act as peace-makers especially among cattle that are quarrelsome. Believing this, people in the old country used to tie such a spray to their yokes before starting out on a long journey."

The name loosestrife is also given to species of the genus *Lythrum* of the family *Lythraceæ*, of which about a dozen species are widely distributed in temperate climates. They are characterized by four-angled stems, usually opposite leaves which are sometimes whorled, and reddish-purple or white flowers, solitary above and whorled lower down the stems. Some are cultivated for ornament in borders and among shrubbery, where they succeed well. The best-known species is the purple loosestrife (*L. salicaria*), which is frequently planted.

LOOT, formerly the plunder taken from an enemy in war, now more specifically, goods of citizens or soldiers of the enemy country taken without authority by the invaders. All civilized nations forbid looting under pain of severe penalties. During the Great War (1914–18), frequent complaints were made by the inhabitants of the occupied regions of Belgium and France that the Germans were systematically looting the country either with the connivance or under the express order of the higher command. After the liberation in November 1918 these complaints were found to have been well founded.

LOPE DE VEGA, **lō-pā dā vā-gä**. See VEGA CARPIO.

LOPES, or LOPEZ, lō'pāth, **Fernao**, Portuguese chronicler: b. about 1380; d. after 1459. He was appointed chief archivist of the kingdom by Dom Joao I in 1434, and spent his life in historical research and the composition of chronicles, which for literary and critical value were unsurpassed in his century. His 'Chronicle of Señor Don John I,' describing the great struggle between Portugal and Castile, invites comparison with Froissart's chronicle on account of its picturesqueness, naïve simplicity and dramatic reality. Equally vigorous are his chronicles of Dom Pedro I and Don Fernando.

LÓPEZ, lō'pāz or lō'pāth, **Carlos Antonio**, President and dictator of Paraguay: b. near Asuncion about 1790; d. there, 19 Sept. 1862. He was educated in Asuncion, studied civil and canon law at the ecclesiastical seminary there and became noted for his legal acquirements. During Dr. Francia's incumbency of the presidency Lopez lived in seclusion to avoid the hostility of the former. After the death of President Francia, in 1840, he was secretary of the junta which controlled Paraguay for a few years. In March 1844 the Paraguay Congress adopted the constitution he had drawn up and elected him President of Paraguay for 10 years. He was re-elected for three years in 1851; and again in 1857 for seven. He followed Francia's policy in the main and became involved in quarrels with foreign nations. In 1859 the United States sent a naval force to the Plata to enforce demands against him. He offered to sumbit the question of damages to arbitration, but afterward evaded the claim. He organized an army and navy and made commercial treaties with several foreign nations, built a railroad and in general furthered the material prosperity of the country. The Congress had empowered him to name his successor at will, and he was succeeded by his son, Francisco Solano López (q.v.).

LÓPEZ, Francisco Solano, Paraguayan President: b. Asuncion, 24 July 1827; d. near the Aquidaban, 1 March 1870. He was the son of Carlos Antonio Lopez (q.v.). He was educated in Paris and in his 18th year his father made him a brigadier-general in the war against Rosas, the dictator of Buenos Aires. He afterward filled some of the principal offices of state, and was sent to Europe in 1853, accredited to the chief courts there. He negotiated treaties with England, France and Sardinia. In 1855 he returned to Paraguay, became Minister of War, and on the death of his father, in 1862, President for 10 years. He had aimed at the foundation of a great inland empire, and as his military preparations were now complete, and his army superior to that of any of the South American states, he began hostilities against Brazil in 1864 by taking possession of the province of Matto Grosso. He was made marshal of the army by Congress and extraordinary powers were granted him. In 1865 he demanded permission of Argentina to cross her territory in order to invade Rio Grande do Sul, Brazil. Permission being refused he seized Corrientes and had a measure of success in his early campaigns. The Argentine Republic and Uruguay allied themselves with Brazil, and after five years' conflict López was reduced to extremities, and was finally surprised on the banks of the Aquidaban by a troop of Brazilian cavalry and slain. López recruited his forces by a conscription of all males between 12 and 70 years. The latter part of his career had been stained by many cruelties and wanton murders. (See PARAGUAY — HISTORY). Consult Thompson, 'The War in Paraguay' (1869); Masterman, 'Seven Eventful Years in Paraguay' (1869); Burton, 'Letters from the Battle Fields of Paraguay' (1871); Washburn, 'History of Paraguay' (1871); Schneider, 'Der Krieg der Triple-Allianz' (1872–75).

LÓPEZ, José Hilario, hō-sā' hē-lä'rē-ō, Colombian politician: b. Popayan, 18 Feb. 1798; d. Neiva, 27 Nov. 1869. He was President of New Granada (Colombia) from 7 March 1849 to 7 March 1852, and in the last-named year slavery was abolished and changes were made looking to the formation of a federal government. In the revolutions of 1854 and 1859–62, he fought with the Federalists and was commander-in-chief for part of this period. He was a member of the provisional government 1862-63, and subsequently President of Tolima. In 1867 he was named commander-in-chief of the army.

LÓPEZ, Martin, the first shipbuilder of the American continents. He was in the employ of Cortés, or formed one of the army of the conqueror when he began his famous march against the city of Mexico (Tenochtitlán). He was a shipbuilder by trade and had been attracted to the New World by the stories of wealth to be had there and the spirit of adventure that had taken possession of all Spain at the beginning of the 16th century. While Cortés was in the city of Mexico for the first time, he made the Emperor Moctezuma a prisoner in his own palace, and to please his captive he had López construct two vessels to navigate the waters of Lake Texcoco, which then surrounded the capital of the Aztecs except on one side. This gave him the idea, a year later, of building a number of larger vessels of various sizes with which to attack the city of Mexico from water while his army continued the siege from land. López built 13 vessels in the neighboring town of Tlaxcala, all brigantines, and some of them of considerable size. He made them in parts, so that they could be carried on the backs of Indian peons over the mountains to the town of Texcoco, where he had them set up. From there a canal a mile and a half long and 12 feet deep was dug to the lake to float the vessels down to it. It required 20,000 men, warriors and carriers, to bring the ships from Tlascala to Texcoco, a distance of 60 miles; and the work of transportation occupied nearly a week. The convoy stretched across the country for six miles. At the Texcoco end of the line 8,000 men were employed for over two months digging the canal to connect the city with the lake. All the Spaniards in Mexico, the Tlaxcalans in Texcoco and thousands of Texcocans, including all the representatives of royalty and nobility, a mighty host in holiday attire, turned out to see the 13 vessels launched (1521) at an elevation of a mile and a half above sea-level. These 13 brigatines played a very important part in the reduction of the capital of the Aztecs. They held the whole water front and prevented the Aztecs getting supplies of food and other necessities; and the guns on the vessels frequently directing a cross-fire at the besieged while the land cannon were pounding them from several other directions. Finally they prevented the escape of the emperor, Guatemotzin and numerous nobles after further defense of the city had become impossible. Consult Letters of Cortés; Diaz del Castillo, Bernal, 'The True History of the Conquest of New Spain'; Prescott, 'The Conquest of Mexico.'

LÓPEZ, Narciso, Cuban revolutionist: b. Venezuela, 1799; d. Havana, Cuba, 1 Sept. 1851. He served for some time in the Spanish army, from which he retired in 1822 with the rank of colonel. After the evacuation of Venezuela by the Spanish troops, he established himself in Cuba, and afterward during a stay at Madrid joined the party of Isabella against Don Carlos, and became successively adjutant of Valdes, governor of the Spanish capital, and senator for Seville, but threw up his offices after the refusal of the Cortés to admit the representatives of Cuba. Valdes became governor-general of that island, and López on returning thither was employed by him in various capacities. He was soon absorbed by the project of throwing off the yoke of Spain, and he proceeded in 1849 to the United States, where he sunk almost his whole fortune in the organization of three successive expeditions to Cuba: the so-called Round island expedition in 1849; the "invasion of Cardenas" expedition in May 1850, both of which failed, and the Bahia-Honda expedition, of August 1851, which ended fatally. López, with several hundred persons of different nationalities whom he had enlisted in various parts of the United States, landed at Morillo, near Havana, where he left 200 of his men under the command of Colonel Crittenden, who were taken by the Spaniards and shot. López went to Las Pozas, where he succeeded in repelling an attack of the Spanish soldiers; but, isolated from his friends, sought refuge in the mountains, where he was captured and taken to Havana. He was sentenced to death, which he met with great firmness. Consult Claiborne, J. F., 'Life and Correspondence of John A. Quitman' (New York 1860); Morales, V., 'Jniciadores y primeros mártires de la revolución cubana' (Habana 1901); D. T., 'El General Narciso López y la Isla de Cuba' (Carácas 1851).

LOPEZ, Cape. See CAPE LOPEZ.

LÓPEZ DE AYALA, Adelardo, Spanish dramatist and politician: b. Seville district, 1 May 1828; d. Madrid, 30 Jan. 1879. He was educated at the University of Seville, and at Madrid in 1851 had his first drama, 'El Hombre de Estado,' produced. In 1857 he was elected deputy from Badajoz to the Cortés, and subsequently he was a member of Alfonso XII's first Cabinet. He was the author of numerous lyrics which take excellent rank in Spanish literature, especially of the 'Epístola.' But he was better known as a dramatist of high literary and popular success skilful in his construction of plot but deficient in his drawing of character. Chief of his plays are 'Tanto por Ciento' (So Much per Cent), which was recognized by the bestowal upon him of a gold crown, and 'Consuelo.' Both are searching arraignments of the principles of modern life.

LÓPEZ DE AYALA, Pedro, pā'drō, Spanish poet: b. Murcia, 1332; d. Calahorra, 1407. He served, with an eye to his own interest, Henry II, John I and Henry III, kings of Castile. He was taken prisoner by the Black Prince at Najara in 1367, and again at Aljabarrota in 1385, and is said to have spent 15 months in an iron cage at Oviedes. He attained the highest dignities, including those of lord chancellor (1398) and high chamberlain of Castile, and wrote the 'Cronicas de los Reyes de Castilla' ('Chronicles of the Kings of Castile,' first complete edition 1780), which covers the period from King Peter to Henry III. In this work he strove to substitute for the dry record of the historiographers a pragmatic account of historical events which is remarkable for its vivid pen portraits. He also wrote lyrics, and the 'Rimado de Palacio' ('Rime of the Palace'), a satiric poem on political and social questions.

LÓPEZ DE LEGAZPI, lā-gāth'pē, or **LEGASPI**, lā-gäs'pē, **Miguel**, Spanish soldier and navigator: b. Zumárraga, about 1510; d. 1572. He went to Mexico in 1545 and for a time served with distinction as chief secretary of the city and government there. As a reward he was placed in command of Velasco's expedition, fitted out in 1564 for the conquest of the Philippines. He took the expedition over in four vessels, arriving there in 1565. He established the first settlement at San Miguel on the island of Cebu. Several parties were sent out to explore and occupy the country, and by May 1571 Lopez had conquered Luzon and in that month founded Manila. He named the islands Isles Filipinas in honor of his sovereign, Philip II. His conquest was accomplished with little trouble due to the tact and kindness of Lopéz.

LOPEZ Y PLANES, lō'pāz or lō'pāth ē plă'nĕs, **Vicente**, Argentine poet: b. Buenos Aires, 1784; d. there, 1856. He was prominent as a soldier and politician, was member of Congress, 1819–25, and provisional President of the republic, 5 July to 13 Aug. 1827. He presided over the Supreme Court of Justice, and was governor of the province of Buenos Aires. He was the author of the ‹Argentine National Hymn› and other poems.

LOPHIODON, an extinct tapir-like animal, found in the Eocene fresh-water deposits of central Europe and to some extent in the White River and neighboring formations of Wyoming. It is one of the early and general types of perissodactyls, or odd-toed ungulates. The genus is typical of a family (*Lophiodontidæ*) which includes also the genera *Hyracotherium*, *Hyrachus*, *Systemodon* and *Orohippus*, and is a very generalized group probably ancestral to the rhinoceroses.

LOPHOBRANCHII, lō-fō-brang'kĭ-ī, a suborder of bony fishes, including the «sea-horses» and «pipe-fishes» (*Syngnathidæ*). See Ichthyology.

LOQUAT lō'kwat, or **JAPAN PLUM**, a shrub or small tree (*Eriobotrya japonica*) of the family *Malaceæ*. It attains heights of about 20 feet, bears thick evergreen leaves near the ends of the branches, and fragrant, woolly, whitish flowers in terminal panicles in late summer and autumn, followed by downy, yellow, oval or pyriform fruits (pomes) which ripen in very early spring. The fruits, which in favorable climates are borne in profusion, are highly esteemed for their sub-acid flesh and their pleasantly flavored seeds, the former being used as a dessert, the latter for flavoring cookery. The tree is a native of Japan and China, whence it has been taken to subtropical climates throughout the world. In the Gulf States and in California it is widely popular as a home fruit, though it appears in Northern markets. In California several highly improved varieties were produced during the closing decade of the last century. In the North it is often grown in conservatories.

LORAIN, lō-rān', Ohio, city, in Lorain County, on the south shore of Lake Erie, at the mouth of the Black River, and on the New York, Chicago and Saint Louis (Nickel Plate), Baltimore and Ohio and other railroads, about 26 miles west of Cleveland. The first permanent settlement was made in 1822 by Barney Meeker. It was incorporated as a village in 1873 and as a city in 1895. It is situated in an agricultural and natural-gas region, and is a shipping port for farm products, for the output of the central Ohio coal fields, and for the lumber and iron ore of a large section of the State. The chief industries of the city are ship-building, coal shipping, manufacturing steel, automatic shovels, stove works, general manufacturing and fishing. The city has excellent public and parish schools, a public library, 22 churches and Saint Joseph's Hospital. About 75 per cent of the inhabitants are American born. The government is vested in a mayor, elected biennially, a unicameral council and administrative boards. The waterworks are owned and operated by the city. Pop. 34,360.

LORCA, lŏr'kā, Spain, city, in the province of Murcia, on the Sangonera River, about 20 miles north of Aguilas, the Mediterranean port. It is an ancient city, established before the Moors came to Spain, as is evidenced by the older houses; but the main part of the city now existing is of Moorish construction. It has a fine old castle, considerable flour and textile manufactures, and in the vicinity are valuable mines of silver, sulphur and lead. The farms in the surrounding country have to be irrigated in the dry seasons, and for the storage of water of the Sangonera a dam, 800 feet long and 160 feet high, was built near the city. In 1802 the dam burst, and the valley was flooded, when many lives were lost. The dam was reconstructed in 1886. Lorca was the scene of many battles between the Christians and the Moors. Pop. 70,807.

LORD, Chester Sanders, American journalist: b. Romulus, N. Y., 18 March 1850. He studied at Hamilton College, was for a time associate editor of the *Oswego* (N. Y.) *Advertiser*, and in 1872 became a member of the staff of the New York *Sun*, and of which he was managing editor in 1880–1913, when he retired from business. He was regent of the University of the State of New York 1897–1904; was re-elected regent in 1909 for the term ending in 1922.

LORD, Edwin Chesley Estes, American geologist and petrographer: b. Brooklyn, N. Y., 7 May 1868. Educated in the public schools of New York City and in Brunswick and Heidelberg, Germany, and in Harvard University, Cambridge. Received the degrees of Ph.D. (Heidelberg) and M.S. (Harvard). He served as field assistant in the United States Geological Survey, 1895–97, was professor of Geology and mineralogy in Hamilton College, New York, 1899–1900, Austin Teaching Fellow and assistant in mineralogy and petrography, Harvard University, 1900–01. He was assistant in petrography and chemistry of the United States Department of Agriculture 1901–04, and has been petrographer in the office of public roads and rural engineering of the United States Department of Agriculture since 1904. He has published a geological and petrographical paper on igneous rocks from Bavaria, Germany, Mexico, Texas and Maine, U. S. A., 1894–1900. Since 1900 has published papers on the petrography of rocks for road building, and the relation of mineral composition and rock structure to the physical properties of road materials, ‘Bulletins 31 and 37,’ Office of Public Roads, and ‘Bulletin 348,’ United States Department of Agriculture; and on the mineral composition and utilization of blast furnace and other slags, Proceedings Seventh International Congress of Applied Chemistry, 1909.

LORD, Herbert Gardiner, American philosopher: b. Boston, 29 March 1849. He was the son of the Rev. Daniel Miner Lord and was graduated at Amherst College in 1871 and at the Union Theological Seminary in 1877. He was ordained to the Presbyterian ministry in 1878 and served as pastor of the church of the Redeemer, Buffalo, 1877–95. During 1895–98 he was professor of philosophy at the School of Pedagogy, University of Buffalo; from 1890 to 1900 was principal of Franklin School, Buffalo; and in 1900 was appointed professor of philosophy at Columbia University. He was one of the joint authors of ‘Essays Philosophical and Psychological in Honor of William James’; and is the author of ‘The Psychology of Courage’ (1918).

LORD, John, American historian and lecturer: b. Portsmouth, N. H., 10 Sept. 1812; d. Stamford, Conn., 15 Dec. 1894. He was graduated from Dartmouth in 1833; studied theology for a time at Andover Theological Seminary, and in his second year there wrote a series of lectures on the Dark Ages, which he delivered soon after during a tour of northern New York. He became an agent of the American Peace Society. Though not ordained to the ministry occupied Congregational pulpits in New Marlboro and Stockbridge, Mass. After 1840 he devoted himself to literary work and lecturing. In 1843–46 he was in England giving lectures on the Middle Ages, and on his return to the United States continued to lecture for many years in the principal towns and cities, giving over 6,000 lectures in all. From 1866–76 he was lecturer on history at Dartmouth College. His lectures were published under the title ‘Beacon Lights of History’ (1883); he also wrote ‘Modern History for Schools’ (1850); ‘The Old Roman World’ (1867); and ‘Ancient States and Empires’ (1869); ‘Points of History’ (1881).

LORD, John King, American educator: b. Cincinnati, Ohio, 21 Oct. 1848. He was graduated at Dartmouth College in 1868. In 1869 he was made a tutor in Latin in Dartmouth; professor of Latin and rhetoric, 1872–80; professor of oratory and *belles-lettres,* 1880–82; associate professor, 1882–92, and after 1892 professor of the Latin language and literature. He was acting president of Dartmouth College, 1892–93; and acting president of the faculty in the absence of the president, 1893–1900. He has edited many Latin textbooks and Chase's ‘History of Dartmouth College’ (Vol. I, 1891), is the author of an ‘Atlas of the Geography and History of the Ancient World’ (1902), and has translated Hertzburg's ‘Geschichte der Römer in Alterthum’ (1902); ‘History of Dartmouth College, 1815–1909’ (1913).

LORD (Anglo-Saxon «hlâford,» for «hlâfweard,» bread-keeper), English title of honor or dignity, used in different senses. In feudal times the lord was the grantor or proprietor of the land, who retained the ultimate property in it, the use only being granted to the tenant. Between the superior lord, or lord paramount, and the actual tenant, stood the lord of the manor or mesne lord. Lord is also a mere title of dignity, attached to certain official stations, which are sometimes hereditary, but sometimes only official or personal. Of the latter may be cited the lord's justices in England and the judges of the Court of Session in Scotland; lord advocate, the chief law officer of the Crown in Scotland; lord mayor and lord provost, the former applied to the chief magistrate in certain English and Irish cities, and the latter to the corresponding officials in several Scottish cities, as lord advocate, or lord mayor, a title applied to the chief magistrates of London, York and Dublin. (See also Lord Chamberlain and Lord Lieutenant). In its most definite sense in English it is equivalent to peer, but does not express any special rank or degree of nobility. The five orders of nobility — dukes, marquises, earls, viscounts and barons — constitute the «lords temporal,» in contradistinction to the prelates of the Church, or «lords spiritual,» that is, such archbishops and bishops of the Church of England as are members of the legislature and sit in the House of Lords. The title is also applied, but only by courtesy, to the sons of dukes and marquises, and to the eldest sons of earls.

LORD CHAMBERLAIN, an officer in England who has control of the establishment attached to the chapels royal; of officers and servants attached to the royal chambers, except of those of the bedchamber; and over the medical men of the household. He appoints royal tradesmen, directs all great royal ceremonies, receives all applications to attend levées and drawing-rooms, superintends the royal wardrobe and the jewel house at the Tower, and licenses theatres and plays, his power extending to the cities of London and Westminster, and certain other parts of the metropolis, as well as to those places within which the sovereign may reside occasionally.

LORD HERBERT OF CHERBURY, The Autobiography of. See Herbert, Edward, Lord Herbert of Cherbury, Autobiography of.

LORD HIGH CHANCELLOR. The highest legal dignitary in the British government and principal legal adviser to the Crown; ex officio president or speaker of the House of Lords and Keeper of the Great Seal. He may fulfill those offices even though not a peer. By virtue of his office he is a Privy Councillor and takes precedence of all but royal dukes and the archbishop of Canterbury. He presides when the House of Lords sits as a Court of Appeal, and reads the speech from the throne in the absence of the sovereign. He is also a member of the judicial committee of the Privy Council; of the commission for giving the royal assent to bills; president of the Chancery division of the High Court and of the Court of Appeal; visitor of all hospitals of royal foundation; general guardian of all infants, idiots and lunatics, and general supervisor of all charitable trusts. It is his duty to nominate the younger and County Court judges and most of the county magistrates, in addition to which he is the patron of numerous ecclesiastical benefices. A Roman Catholic is not eligible for the office. The Lord Chancellor has a seat in the Cabinet and goes out of office with the ministry, with a pension of $25,000. His salary is $75,000.

LORD HOWE ISLANDS, a group of small islands in the Pacific Ocean, nearly 500 miles east of Sydney, Australia. They are of volcanic origin, are steep and mountainous and have a fine climate; area, 3,220 acres. The group was discovered in 1788 by Lieutenant Ball, but was not occupied until 1834; in 1840 New South Wales was given charge of the government. In the surrounding waters there is an abundance of fish. The only article of export is the seed of the palm *Ficus colom naris.* Pop. 107.

LORD OF THE ISLES, a title borne by chiefs who ruled the western islands of Scotland. They were descended from Somerled, the Lord of Argyll, on whom David I conferred the islands of Arran and Bute after he had driven the Norwegians out. The father of John, the first to adopt the title, fought at Bannockburn. John, fourth and last Lord of the Isles, was deprived of his title and estates by the Parliament of May 1493. In 1540 the Lordship of the Isles was annexed to the Scottish crown, and from it the Prince of Wales derives one of his titles.

LORD-LIEUTENANT, a British official of high rank, representing the sovereign, as: (1) The viceroy, or Lord-Lieutenant of Ireland, who is nominally a member of the ministry, and retires from office on the resignation of the Cabinet. The office dates back to a remote period in the English occupation; but since the union its holder has resided in Dublin. His powers are nominally quasi-regal, and he confers the honor of knighthood; but the substance of power is in the hands of the secretary to the Lord-Lieutenant, who is generally a member of the British Cabinet. The abolition of the office is contemplated. (2) The Lord-Lieutenant of a county, the principal honorary official of a county, at whose nomination all deputy-lieutenants and justices of the peace are appointed. The office dates from the time of Henry VIII. He was head of the military organization of the county; but after the Cardwell reorganization in 1871 his powers were transferred to the Secretary for War; but under the territorial scheme of 1907 the ancient authority in defense was to a great extent restored.

LORD-MAYOR'S DAY, the 9th of November, on which a great procession accompanying the newly elected lord mayor of London from Westminster to the Guildhall takes place. The procession, formerly famous for its historical and allegorical devices, notably the huge wooden effigies called Gog and Magog (now deposited in the Guildhall), has recently been shorn of much of the burlesque-spectacular features that formerly attended it.

LORD ORMONT AND HIS AMINTA, a novel, by George Meredith, published in 1894. In this tale the author's enigmatical laughter sounds louder than usual; possessing at the same time a quality which leaves the reader in doubt whether the mirth is at his expense or at the expense of the characters. The basis of the story is founded on the secret marriage of Charles Mordannt, Earl of Peterborough, with Anastasia Robertson.

LORD ULLINS' DAUGHTER, a ballad written by Thomas Campbell in 1809. It became a prime favorite and found its way into many schoolbooks. It was set to music by George Thomson.

LORDS, House of. See GREAT BRITAIN — PARLIAMENT.

LORDS OF THE CONGREGATION, a title given in Scottish Church history to the chief nobles and gentlemen who signed the Covenant of Liberty of Worship (3 Dec. 1557). The whole body of adherents was called the *Congregation,* probably because the word congregation is found so frequently in the document. See CONGREGATION AND COVENANT OF LIBERTY OF WORSHIP.

LORD'S DAY. See SABBATH.

LORD'S PRAYER, The, sometimes called «Our Father» or the «Pater Noster,» from the first two words in English or in Latin; and called the «Lord's Prayer» because taught by our Lord to his disciples. The prayer is given in the Bible, in Saint Matthew vi, and in Saint Luke xi. It is given both as a prayer and as a model or standard of prayer, and in Matthew is introduced by the words: «After this manner therefore pray ye.» In Luke the introduction is: «When ye pray say,» and is followed by the words. There is a difference in the form as given in the two gospels mentioned. In Matthew the words are «Our Father who art in heaven, hallowed be thy name; thy kingdom come; thy will be done as in heaven so upon earth. Give us to-day our daily bread; and forgive us our debts, as we also have forgiven our debtors; and lead us not into temptation; but deliver us from evil. Amen.» In Luke the words are: «Father, hallowed be thy name; thy kingdom come. Give us day by day our daily bread; and forgive us our sins; for we also forgive everyone indebted to us; and lead us not into temptation.»

The doxology, «For thine is the kingdom, and the power, and the glory for ever, Amen,» is not found in many of the best ancient authorities, and for that reason it is omitted in Tischendorf's eighth edition of the New Testament and in the Westcott and Hort Greek New Testament.

The prayer was introduced or taught in the «Sermon on the Mount,» and as given in Matthew consists of nine parts — one salutation or invocation, seven petitions and «Amen.» In the salutation there are three distinct points; first, the word «Father,» implying fatherhood, sonship. Second, the word «Our,» which includes all mankind, a profession of brotherhood, a manifestation of charity in the most effective manner. Third, «Heaven,» where God is in His glory, for where His glory is revealed that is heaven. The seven petitions are usually divided into three parts. The first three petitions refer to the honor of God; the last three to our own advantage; and the fourth petition has an element of both the first and the last groups.

The «Amen» is a common ending to prayer, usually derived from the Hebrew verb meaning «to be firm,» or from a Hebrew noun meaning «truth,» and commonly rendered «so be it» or «may it be so.» In this place its signification is usually regarded as meaning a stronger confirmation of what has just been said. In places in the liturgy of the Roman Catholic, the Protestant Episcopal and the Greek churches where the word «Amen» occurs, it is usually said by the server or clerk; but the «Amen» belonging to the «Lord's Prayer» is said by the celebrant of the mass.

Some of the early writers divided the petitions into six, joining the sixth and seventh. Many Protestant writers make this division, but Roman Catholic writers follow Saint Augustine, and divide the prayer into seven petitions. Lutheran writers generally follow this division, also the Protestant writers, Bleck, Hilgenfield, Keil and Tholuck. The gradation of the petitions is remarkable: First, the honor and glory of God is sought; second, our own greatest good; third, the necessary means to attain eternal life; fourth, necessities for the present life; fifth, to be freed from the greatest evil; sixth, to be freed from the evil next to the greatest; seventh, to be freed from all evil. The fifth, sixth and seventh petitions are directed against the respective impediments opposed to the good mentioned in the second, third and fourth petitions.

The doxology is explained in various ways, as a liturgical addition, as an ancient continuation used by the priests and then the people. The «kingdom» in the doxology seems to refer to the first and second petitions; the «power» to the third petition; and the «glory» to the following petitions.

Directly following the «Lord's Prayer,» in the gospel of Saint Matthew vi, 14, there is an extension or explanation of the fifth petition, giving again the conditions of forgiveness; «For if ye forgive men their trespasses, your heavenly Father will also forgive you.»

Commentators differ as to the exact relation between the form of the «Lord's Prayer» in the gospel of Matthew and in Luke. It is held by many authorities that the prayer was tanght on two different occasions, to different persons, except the apostles who were present on both occasions. Both forms were given as models and both contain the essentials. It appears in the earliest manual of Christian devotion, the 'Didache,' at the beginning of the 2d century, and was first associated, not with the Eucharistic sacrifice, but with the daily offices. The prayer occurs in all ancient liturgies except the so-called Clementine liturgy — given in the Apostolic Constitutions. In all the principal liturgies it occurs shortly before the Communion.

Many polyglot collections of the prayer have been published from the 16th century downward, the most remarkable of which were those of John Chamberlayne in 150 languages (1715), of Conrad Gesner in 200 (1748) and that of Padre Hervaz in 307 (1787). There are expositions of the Lord's Prayer by Origen, Chrysostom, Gregory Nyssa, Cyprian, Luther, Leighton and Tholuck.

Bibliography.— Maas, 'The Gospel According to Saint Matthew'; Kenrick, the gospels of Saints Matthew and Luke in 'The Four Gospels'; Saint Thomas Aquinas, 'The Lord's Prayer'; and the following authors in various writings, Bleck, Meyer, Kiel, Schanz, Spirago, Jannaris, Tholuck, W. Grimm, Hilgenfield, Peischel, Wendt, Weiss, Saint Augustine and Saint Alphonsus. Consult also Plummer in Hastings' 'Dictionary of the Bible' and Nestle and Lambert in the 'Dictionary of Christ and the Gospels,' with authorities quoted thereunder.

LORDS SPIRITUAL, in Great Britain, archbishops and bishops of the Anglican Church who are given seats in the House of Lords. These are the archbishops of Canterbury (the Primate of all England) and York, and 24 of the bishops. The bishops of London, Durham and Winchester are invariably members of the House of Lords; the other bishops are called according to seniority. Suffragan bishops are not eligible for the Upper House. On his retirement from his bishopric the Lord Spiritual ceases to be a member of the House of Lords. The Lords Spiritual are not peers of the realm, but only Lords Spiritual of Parliament. They have no right to demand trial by the House of Lords as peers, but are amenable to the jurisdiction of the ordinary courts of law. Although the Lords Spiritual of the Upper House are distinct from the Lords Temporal, they do not vote separately, but jointly, forming for purposes of legislation one estate. The prelates vote on every subject brought before the Lords, except in trials for high treason and other cases of a criminal nature. On such occasions they never attend or vote; this, however, is in deference to those canon laws which forbid them from participating in matters of blood, and not owing to any Parliamentary requirement. The Spiritual Lords cannot vote or even take their seats in the House unless robed in their ecclesiastical vestments, with rochet, lawn sleeves and mortar-board cap complete. The distinction between peers of the realm and the Lords Spiritual of Parliament also extends to the families of the latter, courtesy titles not being accorded to them.

LORD'S SUPPER (Lat. *Cœna Domini*, Fr. *La Sainte Cène*, Ger. *Abendmahl*), one of the sacraments of the Christian religion, in the observance of which Christians commemorate the death of the Founder of their religion. It is so called because the Lord Jesus Christ instituted the rite when he took his last meal with his disciples. It has also the names of *eucharist* and *communion*, and is celebrated by all Christian bodies however much their views may differ as to its nature and efficacy, except the Quakers. It was instituted at the time of the Jewish passover, as we read in the gospels of Matthew, Mark and Luke, the two former agreeing very closely in their accounts, while that of Luke has features of its own. A brief statement to the same effect is in 1 Cor. xi. There is no corresponding section in the fourth gospel, though in John vi Christ speaks of the eating of his flesh and the drinking of his blood. In all the churches founded by the Apostles the Lord's Supper was introduced. In the 1st and 2d centuries this rite was celebrated in connection with the *agapæ* or *love-feast.* After the 3d century, when the congregations became more numerous, the *agapæ* ceased, and the Lord's Supper was from thence celebrated separately in the churches, in such a way that all present could partake, with the exception of catechumens (that is, Christians not yet baptized) and unbelievers. These were obliged to withdraw when the celebration of the Lord's Supper commenced, because communion was considered as a mysterious act, which was to be withheld from profane eyes. The deacons carried the bread of life to those whom sickness or imprisonment had prevented from being present at the meeting of the congregation. It was always believed to possess a peculiar efficacy, and ideas of the awful and mystical were associated with it. From the first Christians ascribed supernatural power to the rite, and the consecrated bread and wine were regarded as more than mere bread and wine, and as having became, in some mystical way, the body and blood of our Saviour.

In the early Church there was no definite dogmatic formulation of the change undergone by the sacred elements, but in the 9th century, in consequence of the attacks of Berengarius (q.v.) on the doctrine of the Real Presence, the term transubstantiation, commonly ascribed to Paschasius Radbertus, first came into use to describe metaphysically the real and objective change of the elements of bread and wine into the body and blood of Christ. This term was adopted by the Council of Rome in 1079, and confirmed in 1215, in the Fourth Lateran Council, by Innocent III, and has ever since been employed by the Roman Catholic Church as the authentic expression of her faith in the doctrine of the Eucharist. The Council of Trent in the 16th century laid it down as of faith to confess the "change of the whole substance of the bread into the body, of the whole substance (*substantiæ*) of the wine into the blood [of Christ], only the appearances (*species*) of bread and wine remaining; which change the Catholic Church most fitly calls Transubstantiation." The Roman Catholic Church holds that the Eucharist has been both a sacrament and a sacrifice from the beginning. This, she declares, is evident from Christ's words of institution, as narrated in the synoptic gospels, and from Saint Paul's words in his first Epistle to the Corinthians. And unbroken testimony from the Apostles through the Fathers of the Church, she further avers, bears ample evidence to her claim; besides this, she claims that her own witness as the duly divinely appointed guardian of the deposit of revelation and its infallible interpreter commissioned to teach all nations is sufficient seal to the truth of the doctrine. As a sacrament it is the true body and blood of Christ under the appearance of bread and wine to be partaken by the faithful as a means of grace and union with Christ; as a sacrifice it is the unbloody oblation of the body and blood of Christ by a duly appointed minister, that is, priest, by whom alone the elements can be consecrated. Such she declares has been the Christian teaching and practice from the beginning. The reception of the sacrament under both kinds, that is, under the forms of both bread and wine, was general until the Middle Ages, when communion under one kind, bread alone, began to be adopted, partly to avoid the danger of spilling the consecrated wine and partly to counteract a growing heresy that Christ was not received whole and entire under either kind alone. The Council of Constance, in the 15th century, made it universally obligatory to communicate under one kind to meet the heresy of Huss and Jerome of Prague.

The position taken up by the Protestant reformers in the 16th century was that the Church had deviated in the celebration of the Lord's Supper from the purpose of Christ and the example of the apostolic age. Both the German and Swiss reformers agreed in rejecting the doctrine of Transubstantiation and the Mass, maintaining that the Lord's Supper ought always to be celebrated before the whole congregation, and with the administration of both bread and wine. In explaining the words by which the supper was instituted, Luther and Zwinglius differed, and their different opinions on this subject formed the principal subject of the dissension between the Lutheran and Calvinistic churches. Luther took the words, "This is my body," etc., in their literal sense, and maintained that the body and blood of Jesus Christ were united, in a mystical way, with the bread and wine, which, however, remain unchanged, so that the communicant receives, in, with and under the bread and wine, the real body and blood of the Redeemer. Zwinglius, on the other hand, understood the words in a figurative sense: that Jesus Christ meant to say, "The bread and the wine represent my body and my blood." He maintained, therefore, that the bread and wine were mere symbols of the body and the blood of Christ, and that the Lord's Supper was a simple commemoration of the death of Christ, and a profession of belonging to his church, and this view was in substance adopted by the Socinians and Arminians. From this difference of opinion arose a violent dispute between Luther and Zwinglius, which in later times has been continued between the Lutheran and Calvinistic divines. The opinion advanced by Calvin, by which the spiritual presence of the body and blood of Christ is manifest in the communion, and by partaking of which the faithful receiver is brought into union with Christ, through the medium of the Holy Ghost, though it came nearer to the Lutheran doctrine than that of Zwinglius did, yet was essentially different, and therefore also met with a strong opposition from the strict adherents of Luther. The Calvinist position is known as Receptionist or virtualist. Melanchthon inclined to the Calvinistic notion, and so did many other Lutheran divines, who were called, by the opposite party, Philippists and Crypto-Calvinists. The *formula concordiæ*, or articles of religious peace, suppressed the Crypto-Calvinists in the greatest part of the Lutheran Church, and established the position of Luther; consequently there was a final separation of the Lutheran and Reformed or Calvinistic churches, but in recent times many Lutheran divines have inclined to the Calvinistic doctrine. The Greek Church has substantially held the doctrine of Transubstantiation in its whole extent. The Oriental Christians differ from the Western in using leavened bread in the Lord's Supper and in administering it to children. (See GREEK CHURCH).

It thus appears that the differences between the contending churches hinge on the *mode* in which the body and blood of Christ are present in the elements of bread and wine, for that they are in some way way present is admitted by them all. The majority of Protestant churches hold that *presence* means presence in efficacy, and will admit that it is "real" in the sense of being efficacious, though not in the sense of being corporeal. However, when they are called on to define efficacy they differ in this, that some mean by it a sacrificial, and others a mysterious supernatural efficacy, emanating from Christ's glorified body. The confessions of the Protestant churches were framed expressly to conciliate the Lutherans, and contain, in consequence, more of the mystical element than is consistent with the sentiments of the framers, as expressed in their writings. The 28th article of the Church of England, while repudiating Transubstantiation as «repugnant to the plain words of Scripture,» declares «that to such as rightly, worthily, and with faith receive the same, the bread which we break is a partaking of the body of Christ, and likewise the cup of blessing is a partaking of the blood of Christ.» It further declares that «the body of Christ is given, taken, and eaten in the supper only after a heavenly and spiritual manner. And the mean whereby the body of Christ is received and eaten in the supper is faith.» But the High Church party in the Anglican Church makes an approach to the Roman position by belief in what is termed the «objective real presence.» The Westminster Confession, chap. xxix, s. 6 and 7, thus formulates the doctrine adopted by the Presbyterian Church of Scotland, which in the main agrees with that propounded by Calvin: «That doctrine which maintains a change of the substance of bread and wine into the substance of Christ's body and blood (commonly called Transubstantiation) by consecration of a priest, or by any other way, is repugnant not to Scripture alone, but even to common sense and reason, overthroweth the nature of the sacrament, and hath been and is the cause of manifold superstitions, yea, of gross idolatries. Worthy receivers, outwardly partaking of the visible elements in this sacrament, do then also inwardly by faith, really and indeed, yet not carnally and corporally, but spiritually, receive and feed upon Christ crucified, and all benefits of his death: the body and blood of Christ being then not corporally or carnally in, with or under the bread and wine; yet as really, but spiritually, present to the faith of believers in that ordinance, as the elements themselves are to their outward senses.» The elevation, adoration and carrying about of the host, practised in the Greek and Roman Catholic churches, is thus spoken of in the 28th article of the Anglican Church: «The sacrament of the Lord's Supper was not by Christ's ordinance reserved, carried about, lifted up, or worshipped.» While the Roman Catholic Church makes its communicants receive the consecrated wafer with the mouth from the hands of the priest, the Protestant churches put the bread and the chalice into the hands of the communicant.

In the Greek and Roman Catholic churches the Eucharistic sacrifice is offered daily; in the Anglican Church the practice varies, the High Church ideal being a daily celebration of Holy Communion. It was formerly the custom in the Scottish Presbyterian Church to observe the rite once a year; but it is now more frequently administered, generally four times a year.

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LORDWOOD. See LIQUIDAMBAR.

LOREE, Leonor Fresnel, American railroad president: b. Fulton City, Ill., 23 April 1858. In 1877 he was graduated at Rutgers College and the same year entered the railway service as assistant in an engineers' corps of the Pennsylvania Railroad. In 1879-81 he was transitman in the engineer corps of the United States army. He was leveler, transitman and topographer of the preliminary survey and location of the Mexican National Railway from the Rio Grande to Saltillo, Mex., in 1881-83. In the latter year he became assistant engineer of the Chicago division of the Pennsylvania, engineer of the maintenance of way of the I. and V. division in 1884-86, divisional engineer 1886-88 and superintendent of the Cleveland and Pittsburgh division from 1889 to 1896. In 1896-1901 he was general manager of the system and became fourth vice-president in 1901. In 1901-04 he was president of the Baltimore and Ohio Railroad, of the Rock Island Company of New Jersey in 1904. On 10 April 1907 he became president of the Delaware and Hudson Company and is president or director of 34 companies controlled or affiliated with it. Mr. Loree served as chairman of the United States delegation to the International Railway Congress at Paris in 1900. In April 1918 he was appointed member of the War Labor Board, Washington, D. C.

LORELEI, lō'rĕ-lī, or **LURLEI,** loor'lī, a rock on the right bank of the Rhine, near Saint Goar, about 425 feet above the river, through which a tunnel has been bored. Once a serious menace to passengers on the river and always famed for its echo, the rock has been personified by German poets, notably Heine, as a siren, luring sailors to destruction by the music of her voice, an evident idealization of the danger of the rock and of its echo.

LORENTZ, lō'rĕnts, **Hendrik Antoon,** Dutch physicist: b. Arnheim, 1853. He received his education at the University of Leyden; was a teacher for five years in 1872–77 in his native place and in the latter year was made professor of mathematical physics at the Arnheim University. He developed Maxwell's ether theory, and was one of the founders of the electron theory. He arrived at the formula for the function of refraction at the same time as his namesake Lorenz of Copenhagen and subsequently developed the so-called "Zeeman effect." In 1902 Lorentz was awarded, with Zeeman, the Nobel prize for physics. In 1906 he lectured at Columbia University and in 1912–13 at the Collège de France. In 1907 and 1909 he was director of scientific expeditions to New Guinea. His published works include 'La théorie électromagnetique de Maxwell' (1892); 'Versuch einer theorie der electrischen und optischen Erscheinungen in bewegten Körpern' (1895); 'Textbook of Differential and Integral Calculus' (1882; 2d ed., 1907); 'Textbook of Physics' (1888–90; German trans., 1907); 'Zichtbare en onzichtbare bewegingen' (1901; German 1902); 'Abhandlungen über theoretische Physik' (1907); 'The Theory of Electrons' (1909).

LORENZ, lō'rĕnts, **Adolf,** Austrian orthopædic surgeon: b. 1854. He was graduated from the University of Vienna in 1880, and worked as an assistant under Theodor Billroth in Vienna. On the advice of the latter he began specialization in orthopædic surgery, and after years of study developed his so-called "bloodless" method of reducing congenital dislocation of the hip joint. Before he developed his own method of operation he was one of the chief exponents of Hoffa's cutting method, which, however, he modified largely. His operation consists of the forcible stretching of all the soft parts about the hip until the head of the bone can be brought to the place where the socket should be (the acetabulum), and then holding it in that position and rotating the joint to secure it in the depression of the acetabulum. A plaster of paris cast is worn by the patient from six to nine months after the operation. Dr. Lorenz has performed this operation successfully in a large percentage of his cases; he demonstrated his method before the Medical Congress at Berlin in 1895; and has also given demonstrations in England and the United States. His visit to the United States (1902) aroused widespread interest and enthusiasm. He is now professor of orthopædic surgery at the University of Vienna and a government councillor. His publications include 'Orthopädie der Hüftgelenks-Kontrakturen und Ankylosen' (1889); 'Das instrumentelle kombinierte Redressement der Hüftgelenks-Kontrakturen' (1898); 'Ueber die Heilung der angeborenen Hüftgelenks-Verrenkung durch unblutige Einrenkung und functionelle Belastung' (1900); and with Saxl, 'Orthopædics in Medical Practice' (translated by L. C. P. Ritchie (New York 1913).

LORENZ, lō'rentz, **Ottokar,** German historian: b. Iglau, 7 March 1832; d. 1904. His first work was 'The Consular Tribunal' (1855). He was appointed professor of history in the University of Vienna, 1862, and in 1885 accepted a call to the University of Jena. Among his writings are 'German History in the 13th and 14th Centuries' (1863); 'Sources of Mediæval German History' (1870); 'History of Alsace,' with Scherer (1871); 'History and Politics' (1876); 'Genealogical Manual of the History of European States' (1895); 'The Jubilee of Frederick, Duke of Baden' (1902); 'Kaiser William and the Foundations of the Empire from 1866 to 1871' (1902).

LORENZO, lō-rĕn'so, or **LOURENÇO MARQUES,** lō-răn'sō mär'kĕs, East Africa, capital and one of the principal ports of Portuguese East Africa, and the name of one of the districts of the province of Mozambique. The port, which is on Delagoa Bay, is the entrêpot for a great hinterland, including the Transvaal colony. The railway to Pretoria was completed in 1895; a new line to the Swagiland border is under construction, 44 miles being open for traffic in 1915. The number of vessels entered in 1915 was 546. Pop. about 13,514, of which about half are Europeans. See DELAGOA BAY.

LORETA, lō-rä'tạ, **Pietro,** COUNT, Italian surgeon: b. Ravenna, 1831; d. 1889. He received his education at the University of Bologna; became anatomical prosector there in 1861 and four years later became director of the surgical clinic. He was appointed to the chair of surgery at Bologna University in 1868. His publications include 'Nuovo metodo di cistotomia perineale'; 'Nuovo metodo di cura degli aneurismi'; 'La divulsione digitale del piloro'; 'La divulsione instrumentale del cardia'; 'La resizione del fegato.'

LORETO, lō-rä'tō, Italy, city in the province of Ancona, about five miles from the Adriatic Sea and 15 miles south of the city of Ancona. It is situated in a fertile agricultural region, remarkable for its beautiful scenery. It is a famous place of pilgrimage, being visited by about 50,000 pilgrims annually, the centre of attraction being the Santa Casa, said to be the house in which Jesus, Mary and Joseph lived while in Nazareth. The building is 31 feet in length and 13 feet in width. It is enclosed in a stately domed church (the church of the Holy House), the work of Bramante, in which there is a bronze statue of the Virgin and Child by Girolamo Lombardo, and stands under the dome. The original outer walls have been covered, but inside the coarse stonework of the original masonry is visible. The material is a dark reddish-colored stone, unlike the stone in the vicinity. The tradition is that after the power of the Christians was destroyed in Palestine, by the capture of Acre, in 1291, on 10 May 1291, angels moved this house from Nazareth to the hill of Tersatta, near Fiume. After a time, on 10 Dec. 1294, the house was again removed by angels to the opposite side of the Adriatic, near Recanati; and again, in 1295, it was removed to where it now stands. The trade is mainly in the making of crucifixes, rosaries, etc., for the pilgrims. Pop. of commune about 7,066.

LORETO, Peru, an interior department bounded on the north by Ecuador and territory claimed by Ecuador and Colombia, on the east by Brazil, on the south by the departments of Cuzco and Huanuco, and west by Amazonas and Libertad. It is watered for thousands of miles by the Marañon and its tributaries; area, 288,456 square miles; pop., chiefly Indians, about 100,000. The quickest route from the coast to this province, which is only about 700 miles distant in a direct line, is round the northern coast of South America and up the Amazon, a journey of 6,500 miles. Loreto is separated from the coastal departments by the Andes, has a tropical climate and is densely forested; the chief products are rubber, salt, quinine, tobacco and tropical fruits. Rich gold deposits are believed to exist in the river beds. The principal towns are Iquitos, the capital, Moyobamba and Taropoto.

LORETTE, Ancienne, än-sē-ĕn lō-rĕt, Quebec, Canada, a village seven miles south-southwest of Quebec city, on the Canadian Pacific Railway, with industries connected with the waterworks of Quebec on Lake Charles. Pop. 1,600. Three miles to the north is Indian or Jeune Lorette, peopled by about 300 Christianized Indians, descended from the last of the Huron Indians who had found a refuge at Ancienne Lorette in 1650. The settlement was removed to Jeune Lorette in 1697. Jeune Lorette commands a fine view of Quebec, for which it is visited, as also for the falls of Lorette and for its ancient chapel and statue of the Virgin, a replica of those at Loretto, Italy. Pop. 1,588.

LORETTO, or LORETO, Sisters of. See Orders, Religious.

LORIA, lō'rē-ä, **Achille,** Italian economist: b. Mantua 1857. He studied law at Bologna and proceeding successively to Rome, Berlin and London made a study of economical problems. He was professor of economics at Siena, 1881–91; at Padua, 1891–1903; and in the latter year was appointed to Turin. He has approached the subject of wealth distribution and land-tenure in a spirit of optimism and has published many works on the subject. Among his writings are ‘Studii sul valore della moneta’ (1891); ‘La terra ed il sistema sociale’ (1892); ‘La costituzione economica odierna’ (1889); and ‘Il capitalismo e la scienza’ (1901); ‘La scutesi economica’ (1909; Eng. trans., ‘The Economic Synthesis,’ 1914); ‘Le basi economiche della costituzione societa’ (Eng. trans., ‘Economic Foundations of Society’ (1899).

LORICATA (from Latin looricare, to clothe in mail). *In zoology,* (1) the group of pagolins (see Manis); (2) the group of *Crocodilia;* (3) a group of decapod *Crustacea,* which includes the spiny lobsters (*Palinurus,* etc.), and the bear-crabs (*Scyllarus, Ibacus,* etc.). These forms are large, with thick shells and without pinching claws. All are edible, the spiny lobster replacing the true lobster as an article of food in the warmer parts of the earth; (4) *in ichthyology,* a sub-order of ganoid fishes; (5) animalculæ provided with a lorica, such as certain infusorians and rotifers.

LORIENT lō-rē-ŏṅ, or **L'ORIENT,** France, a fortified seaport town, in the department of Morbihan, at the junction of the Scorff with the Blavet, on the Bay of Biscay, about 40 miles west of Vannes. It was founded in 1666 by the French East Indies Company and in 1690 it became a military fort. After the dissolution of the company, in 1782, the government bought the ship-building plant The large harbor can accommodate with safety a great number of vessels. Lorient is a station of the French fleet and has extensive docks, two graving docks and is a great port for naval construction, the shipyards occupying 38 acres. It has also large artillery barracks, an artillery park, a marine arsenal and a great powder magazine in the middle of the channel. It has an observatory, schools of marine, artillery and hydrography and other educational institutions and a large number of manufacturing establishments, including iron foundries and forges. The principal imports are coal, pitch and timber; the exports include oil, wood and sardines and there are extensive oyster beds. Lorient was unsuccessfully attacked by the British in 1746. Pop. about 42,463. About five miles south of Lorient is the fortified town of Port Louis.

L'ORIGNAL, lō'rē'nyạl', Canada, town and county-seat of Prescott County, Ontario, on the Ottawa River and the Canadian Northern Railway, 50 miles east of Ottawa. Steamboats connect it with Ottawa and Montreal. Lumbering is the principal industry. The town is the seat of a Roman Catholic convent and possesses an electric plant. Pop. 1,350.

LORIKEET, a small kind of lory (q.v.).

LORIMER, lôr'ĭ-mėr, **George Claude,** American Baptist clergyman: b. Edinburgh, Scotland, 1838; d. Aix-les-Bains, France, 7 Sept. 1904. He came to the United States in 1856 and was educated at Georgetown College, Kentucky. In 1859 he was ordained to the Baptist ministry and held pastorates at Harrodsburg, Paducah and Louisville, Ky.; he was then at Albany for a short time, at the Shawmut Avenue Church and Tremont Temple in Boston in 1870–79 and in Chicago till 1891. In the latter year he returned to Boston to become pastor at Tremont Temple. In 1902 he went to New York as pastor of the Madison Avenue Church. He was associate editor of the *Watchman* and wrote ‘Isms Old and New’ (1882); ‘Under the Evergreens’ (1872); ‘The Great Conflict’ (1876); ‘Studies in Social Life’ (1886); ‘Christianity and the Social State’; ‘Christianity in the Nineteenth Century’; ‘Messages of To-day to the Men of To-morrow’ (1897); ‘Master of Millions’ (1903), a story of modern life; ‘The Modern Crisis in Religion’ (1904). He edited ‘The People's Bible History Prepared in the Light of Recent Investigations’ (1895).

LORIMER, George Horace, American editor and author: b. Louisville, Ky., 6 Oct. 1868. He was educated at the Mosely High School, Chicago, at Colby and at Yale. He was engaged in business in Chicago until 1896 when he became a reporter and correspondent, 1896–97. He became literary editor and managing editor of the *Saturday Evening Post* 1897, becoming its editor-in-chief in 1899. His remarkable faculty of discerning popular taste and fancy has made for the immense success of that periodical. His best-known work is ‘Letters of a Self-Made Merchant to His Son’ (1902), remarkable for its humor, wit and use of slang to drive home a work-a-day philosophy. Other works are ‘Old Gorgon Graham’ (1904); ‘The False Gods’ (1906); ‘Jack Spurlock — Prodigal’ (1908).

LORIMER, John Henry, English painter: b. Edinburgh, 1856. He was educated at the Edinburgh Academy and University and began his art studies at the Royal Scottish Academy. One of his pictures was admittted to the annual exhibition of that institution when he was but 19. He was elected a member of the Royal Scottish Academy in 1900. His most important exhibited pictures are ‘The Ordination of Elders’; ‘Pot Pourri’; ‘The Eleventh Hour’ (1896), which in 1900 was awarded a gold medal at the Paris Exposition. In 1894 the French government bought his ‘Benedicite,’ which is now in the Luxembourg, where his portrait of Col. Anstruther Thompson has also been deposited.

LORIMER, William, American capitalist and politician: b. Manchester, England, 27 April 1861. At the age of five he came to the United States with his parents and in 1870 to Chicago. At 10 he became a sign-painter's apprentice and subsequently obtained employment in packing-houses and with a street railroad company. He received no schooling, but obtained the rudiments of an education through his own efforts. He entered the real estate business in 1886 and later was member of the firm of Murphy and Lorimer in building and brick manufacturing business. Since 1900 he has been a member of the contracting firm of Lorimer and Gallagher. He was connected with the Chicago water department as superintendent of water-main extensions and later superintendent, in 1887–93. Lorimer was a member of Congress from 1895 to 1909, with the exception of the term 1901–03. On 26 May 1909 Lorimer was elected United States senator for the term 1909–15. He resigned from the House of Representatives and took his seat in the Senate on 18 June 1909. The validity of his election was challenged in the Senate, 9 Jan. 1911. By a vote of 46 to 40, on 1 March 1911, the challenge was not sustained. This decision was unpopular as corrupt practices were suspected to have secured the election and when Congress reconvened the Senate decided to reopen the investigation (1 June 1911). A majority of the Committee on Privileges and Elections reported that Lorimer's election had not been brought about by corrupt practices. A bitter quarrel followed in the Senate, which divided into reactionaries and progressives irrespective of old party lines and on 14 July 1912 a resolution was sustained by a vote of 55 to 28, declaring that corrupt methods and practices had been employed in the election; that the election was in consequence invalid; and Lorimer's seat vacant. Almost a direct result of the Lorimer case was the triumph of the movement for the election of United States senators by direct popular vote. From 1910 to 1915 Lorimer was president of the La Salle Street Trust and Savings Bank. This and a number of affiliated concerns failed in 1914, and Lorimer and several others were indicted for misappropriation of funds.

LORING, lōr'ĭng, **Charles Greely,** American lawyer and orator: b. Beverly, Mass., 1794; d. 1868. He was graduated from Harvard in 1812 and practised his profession in Boston, becoming in 1857 actuary of the Massachusetts Hospital Life Insurance Company. In 1862 he entered the State senate. He was of much prominence as an orator and a prominent member of the Massachusetts Historical Society, was the author of ‘Neutral Relations between the United States and England’ (1863); ‘Life of William Sturgis’ (1864).

LORING, Charles Greely, son of the preceding: b. Boston, 1828; d. Pride's Crossing, Beverly, Mass., 20 Aug. 1902. He was graduated from Harvard in 1848 and served in the Union army during the Civil War, being brevetted major-general of volunteers at its close. He became a trustee of the American Museum of Fine Arts in 1873 and was the executive officer of the institution from 1876 until his death.

LORING, Charles Harding, American naval engineer: b. Boston, Mass., 1828; d. 1907. He received his education in the public schools; became a machinist's apprentice and in 1851 was appointed third assistant engineer in the United States navy. During the Civil War he was civil engineer of the *Minnesota* and participated in the action with the ironclad *Merrimac*. Afterward he had charge of the construction of monitors; was fleet engineer of the Asiatic squadron and in 1881 became a member of the first Naval Advisory Board. In 1884 he was engineer-in-chief of the United States navy, a position he held until his retirement in 1890. When war broke out with Spain in 1898 he was made inspector of engineering work at the New York navy yard. He was honored, in 1892, with the presidency of the American Society of Mechanical Engineers.

LORING, Ellis Gray, American lawyer: b. Boston, 1803; d. 1858. He was educated at the Boston Latin School, entered Harvard in 1819, but without graduating left college and studied law. In 1827 he was admitted to the bar, where he soon won high distinction. He was one of the first pleaders for the abolition of slavery and one of the founders of the first anti-slavery society, in Boston, 1832, whose constitution he wrote. As a defender of fugitive slaves he gave freely of his time and talents and shared the odium visited upon all the early abolitionists. Before the Supreme Court of Massachusetts he made a memorable defense of a slave-child called Med, by which, against so formidable an opponent as Benjamin R. Curtis (q.v.), he secured a decision declaring that every slave brought into that State thereby became legally free. The effect of his convincing argument was both instantaneous and lasting, and his triumph was a substantial service to the anti-slavery cause. He published numerous addresses on the slavery question.

LORING, George Bailey, American agriculturist: b. North Andover, Mass., 8 Nov. 1817; d. Salem, Mass., 14 Sept. 1891. He was graduated from Harvard in 1838 and from the Harvard Medical School in 1842, and after several years of medical work at the Chelsea Marine Hospital devoted himself from 1850 onward to scientific agriculture, writing many essays and papers on farming and allied topics. He became famous as an orator, served several terms in Massachusetts legislature, was member of Congress 1876–81, United States Commissioner of Agriculture 1881–85 and Minister to Portugual 1889–90.

He was president of the Massachusetts State Agricultural Society for many years and a member of the Republican national conventions of 1868 and 1872. He published 'The Farm-Yard Club of Jotham' (1876).

LORING, William Wing, American soldier: b. Wilmington, N. C., 4 Dec. 1818; d. 30 Dec. 1886. He entered the United States army as a private in a troop of volunteer cavalry and was active in the Florida War in 1835–42. He studied at Georgetown College and then volunteered in the Texas struggle for independence. From 1839 to 1842 he was a member of the Florida Territorial legislature and in the latter year was admitted to the bar. During the war with Mexico he was distinguished for bravery at Contreras, Churubusco and Chapultepec and was brevetted lieutenant-colonel and colonel. In 1849–51 he commanded the troops in the Department of Oregon and campaigned against the Indians in the Rio Grande region 1851–56. In 1857–58 he served under A. S. Johnston in Utah. Although opposed to secession he held State Right views and in May 1861 resigned his commission and became a brigadier-general in the Confederate army and later major-general. He served in West Virginia and as a corps commander in Georgia, Mississippi and Tennessee; was active in the Vicksburg and Atlanta campaigns and served as second in command to John B. Hood at Franklin and Nashville. He also served under Joseph E. Johnston in the Carolinas, and with him surrendered to Sherman in April 1865. For a few years after the close of the war he was a banker in New York, then went to Egypt in 1869 and was made a pasha and chief of staff in the army of the Khedive. He reorganized the Egyptian army with great success, was successively commandant of Alexandria, chief of the coast defenses and general of division. In 1879 he returned to the United Stees and published a description of his Oriental experiences in 'A Confederate Soldier in Egypt' (1883).

LORIS. See LEMUR.

LORIS-MELIKOFF, lŏ'rĭs-mĕl'i-kŏf, **Mikhail Tarielovitch Tainoff,** COUNT, Russian soldier and statesman: b. Tiflis, Russia, 1 Jan. 1826; d. Nice, France, 22 Dec. 1888. He was of Armenian descent, entered the army in 1843, served in several campaigns in the Caucasus and became major-general in his 30th year and distinguished himself at the capture of Kars in 1854. He served in the Crimean War and was made lieutenant-general in 1863. In the Turco-Russian War of 1877 he won the victory of Aladja Dagh in October, following up which he took Kars in November and for his services in the campaign was made a count in 1878. He was recalled from Tiflis (where in charge of several districts he had introduced liberal reforms) during the Nihilist menace in 1879, and in 1880 was appointed Minister of the Interior, in which post he began by introducing liberal measures, but the assassination of the Tsar (13 March 1881) was followed by the adoption of a reactionary policy on the accession of Alexander III, his position became untenable and he resigned.

LORNA DOONE, by Richard Doddridge Blackmore, published in 1869, was one of the earliest and by far the most popular of all Blackmore's dozen or more novels. By some critics it has been esteemed one of the great pieces of English fiction, but this praise is undoubtedly excessive. The theme is entirely romantic, there being little realism and no «problem» writing whatever. It is the theme of apparently hopeless, but finally triumphant, love; of feminine pity and distress; of manly courtesy and resolution; of the success of the noble-hearted and the discomfiting of evil men. John Ridd, a young rustic giant of North Devon, rescues the high-born Lorna from the hands of her outlaw relatives and finally rises not only to the possession of Lorna's hand, but to high position on the strength of his own merit. There is some historical background out of the reigns of Charles II and James II, most vividly represented at the battle of Sedgemoor. The Doones themselves are largely legendary. Probably their formidableness and knavery are very much exaggerated over any actual facts, just as the scenery of Devon and Somerset, especially the description of Doone Valley, are great exaggerations. Interwoven with the romantic and semi-historical pictures of the tale are many pleasant details of country life and many quiet scenes and adventures of a placid rural sort. The length of the story is not diminished by being told in the first person by the hero, but it is full of honest spirit and of attractive detail.

WILLIAM T. BREWSTER.

LORNE, lôrn, MARQUIS OF (JOHN GEORGE DOUGLAS SUTHERLAND CAMPBELL). See ARGYLE, CAMPBELLS OF.

LORRAINE, Claude. See CLAUDE LORRAINE.

LORRAINE, lŏ-rān', or **LOTHARINGIA,** a province of France, situated on its northeastern frontier and includes such important towns as Metz and Thionville. It was incorporated in the Germanic Empire in 855, when Lothair II, son of the Emperor Lothair I, obtained the lands between the Scheldt, Meuse and Rhine, called Lotharingia, or Lorraine. It at first included Alsace and Friesland; but these provinces were separated in 870, being divided between Louis the German and Charles the Bald, king of the West Franks. About 911 the county of Lorraine was elevated into a dukedom. In 945 it was divided into two parts, Upper and Lower Lorraine. Lower Lorraine came into possession of the dukes of Brabant in the 13th century and from that time was known as Brabant. Philip the Good of Burgundy incorporated it in his dominions in 1429 and it now forms part of the kingdom of Belgium and province of Brabant and Guelderland in Holland. Upper Lorraine continued to be governed by its own dukes until 1736, was given to Stanislas, ex-king of Poland, and on his death in 1766 was awarded to France. It was afterward divided into four departments, Meuse, Moselle, Meurthe and Vosges. The district between Metz and the Vosges, which includes Metz and Thionville, was ceded to Germany at the close of the Franco-German War, under the Treaty of Frankfort, 10 May 1871, and was part of the Reischland of Alsace-Lothringen, until its occupation by the troops of the Allied nations in December 1918.

LORTZING, lôrts'ing, **Gustav Albert**, German composer: b. Berlin, 23 Oct. 1801; d. there, 21 Jan. 1851. His parents were actors and at 19 young Lortzing made his theatrical début at Aachen and Düsseldorf. In 1824 he brought out his first opera, 'Ali Pascha von Jannina,' but attracted little notice. Two years later he became a member of the Court Theatre Company at Detmold. 'Der Pole und sein Kind' appeared in 1831. Lortzing's fame, however, rests on the two operas, 'Czar und Zimmermann' (1837) and 'Der Wildschütz' (1842). The former is one of the masterpieces of comic opera and still holds the boards in German opera-houses, although it was indifferently received at its first production at Leipzig. 'Undine' appeared in 1845 and 'Der Waffenschmied' in 1846. Lortzing was made conductor of the Leipzig Opera in 1844, but resigned soon afterward after a quarrel with the management. He was reinstated through the influence of friends, but his temperamental nature soon involved him in a second quarrel and brought about his removal. He was made capellmaster of the Friedrich Wilhelmstadtisches Theatre, Berlin, in 1850. Consult Kruse, G. R., 'Albert Lortzing' (Berlin 1899) and Wittmann, Herman, 'Lortzing' (Leipzig 1889).

LORY, any of several East Indian and Australian parrots, but more especially one of the brush-tongued Australian family *Trichoglossidæ*, the smaller examples of which go by the name of lorikeets. Both the lories and the lorikeets are remarkable for their extensible tongue, furnished with a pencil at its extremity, by which they are enabled to lick up the nectar of flowers. In doing so they carry pollen from blossom to blossom, performing an important service of cross-fertilization, especially for the eucalyptus trees. (See FLOWERS, FERTILIZATION OF, BY BIRDS). The lorikeets are smaller than the lories and have long tapering tail-feathers. Swainson's lorikeet (*T. novæhollandiæ*) is the best-known species. It is found in eastern Australia and Tasmania and is popularly known as the Blue Mountain lory or the Blue Mountaineer.

The name lory is also given to the large, brilliantly colored parrots of the psittacine genus *Eclectus*. Consult Newton, 'Dictionary of Birds' (1896); Evans, 'Birds' (in Cambridge Natural History, Vol. IX, New York 1901); and see PARROTS.

LOS ANGELES, Cal., city, county-seat of Los Angeles County, about 15 miles in an air line from the Pacific Ocean, in the valley of the Los Angeles River, a dry river-bed in summer, but in winter a considerable stream after heavy rainfalls. The Sierra Madre range of mountains, about 10 miles north of Los Angeles, may be seen from most any part of the city. There is also a lower range of mountains extending from the city to the ocean. Originally Los Angeles covered an area of 36 square miles, extending three miles in each direction from the old plaza. Within the past few years numerous additions have been made, including a "shoe-string strip" extending from the city to the ocean and taking in the ports of Wilmington and San Pedro. The area at present is 351.1 square miles. The average altitude is 270 feet above sea-level. The northern part of the city is hilly.

The city has railroad competition in four transcontinental lines, two southern Pacific systems, by way of Ogden and El Paso, the Santa Fé, by way of Albuquerque, and the Los Angeles and Salt Lake Railroad, from Salt Lake. Altogether there are a dozen lines of railroad leading to Los Angeles, including an elaborate suburban electric railroad system, aggregating over 1,100 miles of track, some of the lines having four tracks. The electric street railway system is also extensive, the total mileage of single track being over 300 miles. Half a dozen lines run large and commodious steamships 475 miles northward to San Francisco, also to Portland and Puget Sound on the north, and to San Diego on the south.

Los Angeles Harbor is guarded from the rare storms of the Pacific by a breakwater two and one-half miles long, built by the United States government at a cost of $3,500,000. Active work has been accomplished on the further dredging of the harbor, construction of wharves and warehouses. The harbor is municipally owned and controlled. The harbor projects under construction include 21½ miles of municipal wharfage, besides a large area of wharfage under private ownership. Los Angeles Harbor is absolutely safe and in any weather may be entered by vessels under their own power. Los Angeles has the advantage of being located on the shortest road by the lowest grades between the Atlantic and Pacific oceans. Since the opening of the Panama Canal it is close to the direct route of vessels sailing from the Atlantic to the Orient. Los Angeles is the commercial and social metropolis of the Southwest, including southern California, southern Nevada and Arizona. It also does a large and increasing trade with northern Mexico, Central and South America. The two most important products of the country surrounding Los Angeles are citrus fruits and petroleum. The annual value of the orange and lemon output of this section is about $40,000,000. These fruits are marketed under a thoroughly organized co-operative system of distribution. Los Angeles is the central distributing point for important petroleum fields with an annual output aggregating about $40,000,000. There are half a dozen beet sugar factories in the country tributary to Los Angeles, with a total output of $18,000,000. Other important products of the surrounding country are beans and other vegetables, deciduous fruits, walnuts and grain. Los Angeles is rapidly becoming an important manufacturing city, possessing great advantages in the way of mild climate and cheap fuel in the shape of crude petroleum and electric power, derived from mountain streams. The annual value of its manufactured products is placed at $140,000,000. There are 32 banks in the city with a total combined annual clearance of about $1,293,000,000. Building operations have an annual average value of about $20,000,000.

Los Angeles is a residential city, a large proportion of the people owning their own dwellings. The city is practically frostless; callas, heliotropes and other delicate plants flourishing throughout the winter in the open air. The residence streets are generally aligned by evergreen shade trees. The city is the seat of the University of Southern California, a Methodist establishment. Occidental

College is conducted by the Presbyterians. The Roman Catholics have a college and three academies. There is a State normal school, several high schools, a polytechnic high school, a public library with nearly 280,000 volumes, 350 handsome church buildings of all leading denominations and a model institutional church. There are 25 public parks within the city limits, aggregating over 4,000 acres, four of them having lakes of considerable size. The city derives its water supply from the snow-clad slopes of Mount Whitney, in Owens Valley, 240 miles from Los Angeles, and from wells. A sewer system extends to the ocean. The mayor of Los Angeles holds office for two years. He appoints five trustees for the library and is ex officio a member and chairman of several committees. The city council of nine members, chosen by election from the city at large, has four commissioners who have charge respectively of police, health, fire and park departments. The board of education consists of nine members chosen by election from the city at large.

The pious Spanish pioneers who first introduced civilization in Alta, California, were in the habit of giving names to places in accordance with the Church calendar. Consequently, when mass was first celebrated on the present site of the city, in 1781, it was named Nuestra Senora Reina de Los Angeles, which the practical Yankees upon their arrival at once proceeded to abbreviate.

The growth of Los Angeles has been remarkable. Until 1817 Los Angeles alternated with Monterey as the seat of Mexican provincial government of Alta, California. In 1846 it was taken by Commodore Stockton of the United States navy. It received its city charter in 1851. In 1850 its population was 1,610. The census of 1880 gave it a population of 11,311. The census of 1910 gave it 319,198. In 1914 the government estimate of the population was 438,914, and the present estimated population is 590,000.

LOS INTERESES CREADOS, lŏs ĭn'tā-rā'sĕs krā'ą-dȯs ('The Bonds of Interest'), by Jacinto Benavente, the most popular and widely-known production of Spanish letters during the 20th century, was first presented at Madrid, 9 Dec. 1907. With this comedy the modern movement in Spanish art attained full maturity, the play taking its place immediately among the classics of the stage. The theme is the duality of human nature in the conflict between the real and the ideal, ever present to the Spaniard in the persons of Don Quixote and Sancho Panza, but here transferred to the domain of the will and embodied in Leander and his servant, the rogue Crispin, to whom falls the task of grovelling that his master may rise. The philosophy of the play is pragmatic, while life is depicted as a series of approximations incapable of unification. In feeling and technique, 'Los Intereses Creados' belongs to the neo-romantic school, of which it must be accounted one of the finest examples. Delicacy of poetic feeling is combined with an unfailing many-sided humanity in a portrayal of varied lights and shades, which is reinforced by the vivid colors of the satiric picaresque tradition, and couched in a diction which is among the most notable specimens of modern Spanish prose. Although employing the forms of the Italian *commedia dell' arte* Benavente achieves as in his other works an absolute de-artificialization of theatric effect. A continuation, 'La Ciudad Alegre y Confiada,' followed in 1916, but in this the intellectual element is directly predominant, both in conception and style, the second part being wholly distinct from its predecessor.

'Los Intereses Creados' has been translated into the principal European languages. It is included in Benavante's 'Teatro' (Vol. XVI, Madrid 1908), having previously been issued independently by the Sociedad de Autores Españoles. The English version is published in the 'Plays by Jacinto Benavente' (New York 1917).

JOHN GARRETT UNDERHILL.

LOS SUEÑOS, lŏs sŭā'nyŏs. Francisco Gómez Quevedo Villega composed his 'Sueños,' or 'Visions,' at intervals between the years 1606 and 1627, at which latter date they were first published at Barcelona. The conception of a dream or vision of the other world, peopled by contemporaries of the author in this, was familiar in mediæval literature, and is utilized by Quevedo with full realization of its possibilities in the sphere of personal satire and scandalous attack. The satire of the 'Sueños' is rather journalistic than philosophic, more akin to the opportunism and animosities of the periodical press than to the spirit of *belles-lettres*. Ductile and incisive by turns, the humor is both crushing and keen. Clergy, physicians, merchants, Jews, actors, poets, all the cherished abominations of the author, pass in rapid kaleidoscopic review, more effective indeed at the outset, as in the "Vision of the Last Judgment," and in miniature than in the later pages, which suffer from the repetition inevitable in the monotony of the scheme. Usually reckoned as six in number, an additional vision is admitted by many editors — "La Hora de Todos y la Fortuna con Seso." Mature and highly mannered in style, this was printed posthumously in 1658, constituting a substantial volume in itself. It is properly a *cento* of later writings of the author. The earlier 'Visions' circulated in manuscript, or surreptitiously as pamphlets. Two years after the first collected edition, a reprinting under the title 'Juguetes de la Niñez y Travesuras del Ingenio' was authorized by the Inquisition at Madrid (1629), the more offensive passages being deleted, and the text revised through the substitution of names of pagan deities for those of the Christian dispensation. Although inferior in directness and energy, this version is that which has since been commonly known. The standard Spanish text, edited by Aurelio Fernández Guerra, is included in the 'Obras' of Quevedo, 'Biblioteca de Autores Españoles' (Vols. XXIII and XLVIII, Madrid 1880 et seq.). The 'Sueños' are also reprinted in the series of 'Clásicos Castellanos' (2 vols., Madrid 1916–17), with an introduction by Julio Cejador y Frauca. The familiar English version is by Sir Roger L'Estrange.

JOHN GARRETT UNDERHILL.

LOSE, George William, American clergyman and author: b. Pleasant Unity, Westmoreland County, Pa., 28 Sept. 1852; was graduated Capital University, Columbus, Ohio, 1871, and from the theological seminary of same institution 1874. Entered the Lutheran ministry and held several pastorates in Ohio and Pennsylvania. Editor of several Lutheran periodicals and author of many books, including 'Esther and Other Poems' (1883); 'The Triumph of Faith' (1888); 'The Lives of the Twelve Apostles' (1888); 'From Darkness to Light' (1898); 'The Pace that Kills' (1905); 'Ralph the Orphan' (1906); 'Bread Upon the Waters' (1908); 'The Secret of Happiness' (1909); 'Christmas Eve at Eddington Place'; 'The Melnore Parish'; 'The Song of the Pilgrim'; 'Promises Fulfilled'; 'Their Mother's Prayers'; 'Theodore'; 'Dorothy'; 'The Better Way'; 'A Good Investment'; 'Zauni'; 'Commit Thy Way unto the Lord'; 'The Sandrock Estate'; 'Lifting the Sandhill Mortgage'; 'Aunt Hannah's Cup of Cold Water'; 'The Last Son'; 'The Good Shepherd'; 'Clouds and Sunshine' (1914); 'Coals of Fire' (1914); 'Through the Fire' (1914); 'Catechism Bible Narratives' (1915).

LOSSING, lŏs'ĭng, **Benson John,** American historian and engraver: b. Beekman, Dutchess County, N. Y., 12 Feb. 1813; d. near Dover Plains, N. J., 3 June 1891. In 1826 he was apprenticed to a watchmaker in Poughkeepsie and subsequently entered into partnership with his employer, but in 1835 relinquished the business and became joint owner and editor of the *Poughkeepsie Telegraph.* He soon after settled in New York as an engraver on wood, and at the same time edited and illustrated the *Family Magazine.* His connection with his newspaper enterprises in Poughkeepsie, however, continued until 1841. That year appeared his 'Outline History of the Fine Arts,' followed in 1847 by an illustrated work, 'Seventeen Hundred and Seventy-Six,' and in 1848 by 'Lives of the Signers of the Declaration of Independence.' His 'Pictorial Field Book of the Revolution' was issued in numbers in 1850-52, with more than 1,000 illustrations by himself. In the preparation of this work, which is remarkable for the minute and accurate information which it conveys, the author traveled at different times upward of 9,000 miles, visiting every important battlefield of the Revolution and making sketches on the spot. Among other works are 'Illustrated History of the United States for Schools and Families' (1854); 'Our Countrymen, or Brief Memoirs of Eminent Americans' (1855); 'Primary History of the United States' (1857); 'Mount Vernon and its Associations,' illustrated by himself (1859); 'Life and Times of Philip Schuyler' (1860); 'Life of Washington' (3 vols., 1860); 'Lives of the Presidents'; 'Pictorial Field Book of the War of 1812' (1868); 'The Civil War in America' (1866-68); 'The American Centenary' (1876); 'Cyclopedia of United States History' (1881); 'History of New York City' (1884); 'Compendious History of the Commonwealth of New York' (1887).

LOST CAUSE, The, a phrase which first became current through the title of a history of the Civil War (1886) by E. A. Pollard. It is used as an expressive designation for the purposes and aims which the Southern people, through the war, vainly sought to realize in the permanent establishment of the Confederate States of America.

LOST CHORD, The, title of poem written by Adelaide A. Proctor. It was first printed in *Household Words,* and appeared again in her collection of 'Legends and Lyrics' (1858). The verses became widely known when set to music by Sir Arthur Sullivan; his mood was so attuned to that of the poet that words and music both sound a strain of grandeur, intellectual and emotional, mutually interpretative.

LOST or HIDDEN ISLAND, an appellation anciently applied to Cephalonia, early navigators often being unable to find it on account of its diminutive size. The name also has been given to islands in different parts of the world that once discovered have disappeared or have not been found again.

LOST PARADISE, The. The symbolical title of 'Das verlorene Paradies' ("The Lost Paradise") (1892) by Ludwig Fulda designates the world in which the vast majority of men and women eat bread in the sweat of their brows. The play is intended to arouse sympathy for workmen who strike rather than see their families starve. Contrasted with their state is that of an absentee Berlin proprietor whose luxurious mode of life leaves but a narrow margin for charitable concessions to his workmen, and who is just now especially impeded by having admitted to equal partnership in the business a young man of aristocratic name about to become his son-in-law. The latter attempts to cow the laborers into submission. But the daughter, visiting the factory for the first time on the occasion of her betrothed's appearance there, is touched with pity for the employees, and is stirred to such indignation at the bargain for a son-in-law which her parents have made that she breaks the engagement and beseeches her father to grant the demanded increase of wages.

The drama reflects conditions in Germany rather than any conceivable conditions among us. No American manufacturer would suppose that a gilded youth — though the son of an inventor — could assume the management of a machine-shop, or could avert a strike; none would regard his business as merely the dowry of his daughter, or would face bankruptcy rather than dispense with a socially distinguished son-in-law. And even in Germany Herr Bernardi's daughter — sophisticated, but inexperienced, unused to feeling and yet sensitive to others' wrongs — is an unlikely product of her environment. The superintendent of the factory has a keen sense of the joy of work and of social justice; Bernardi's attitude is a mixture of aloofness and sentimentality. The play contains a number of dramatic moments and an abundance of realistic dialogue, but also considerable stretches of sententious conversation. Translated by H. C. De Mille (New York 1897); edited by P. H. Grummann (Boston 1906).

William G. Howard,
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LOST PLEIAD, plē'ăd, a star of the Pleiades constellation which tradition says was once visible, being the seventh of that cluster, Only six stars are now to be seen with the naked eye. In mythology the lost Pleiad is said to represent both Merope and Sterope who hid themselves ashamed at having married mortals; also as Electra, mother by Jupiter of Dardamus, who fled to avoid seeing the fall of Troy. The legend figures in modern poetry and art; a poem by Letitia Landon and a painting by Thomas Buchanan Read each bear the title.

LOST TEN TRIBES, The. After the death of Solomon the 10 northern tribes of Israel seceded and established the separate kingdom of Israel. It existed for 200 years, until it was finally brought to an end when Samaria was overthrown by Sargon of Assyria in 722 B.C. At that time 27,000 people were taken to different parts of the Assyrian Empire. It was formerly one of the puzzles of history to know what finally became of the Ten Tribes. There were several theories. Because of the fact that some Jewish monuments were found in China some writers traced them to that land. Others found their descendants in India. The theory that the Anglo-Saxons were the descendants of the Ten Tribes had many propagators, and the Anglo-Israelite theory, as it is called, produced a large literature. The general consensus of scientific opinion, however, is that the tribes became absorbed, as subsequent vanished races have, in neighboring nations, and thus were not lost in the real significance of the term. In the Palestinian Talmud and Midrach Gen. Rabba lxiii, the region of the exile of the 10 tribes is recorded as around the river Sabbation (q.v.), the Sabbatic River, so named from the sacred Sabbath of the Jews, identified in modern times with the stream running from the seven-days intermittent spring Fauwar ed-Deir in the Lebanon. In the ‹Eldad ha-Dani,› the narrative of Eldad the Danite which appeared in northern Africa about the 9th century, and the source of considerable mediæval legend and speculation, the lost children of Moses are described as a powerful Utopian race whose territory was surrounded by this wonderful river. Among recent recensions of his text are Epstein's edition (Pressburg 1891) and Müller, D. H., in the *Denkschriften* of the Vienna Academy (*Phil-hist.* cl. xli, I p. 41). Dr. Giles Fletcher (1548–1611) identified the Tartars with the lost 10 tribes; consult his ‹The Tartars,› printed in ‹Israel Redux,› edited by S. Lee (1667). Dr. Whiston (1667–1752) revived this identification. Dr. François Bernier (1620–88), French physician for 12 years to the Great Mogul of India, in ‹Les voyages de Bernier contenant la description des Etats du Grand Mogul de l'Hindoustan› (1699), speculates on the Kashmiris as descendants of the lost 10 tribes from certain customs and rites, and the prevailing type of facial features, as also of the neighboring Afghans and the Tajiks of Badakshan, being distinctly Hebraic. Numerous authors propagated the doctrine that the British races are descendants of the lost 10 tribes. (See Anglo-Israelite Theory). Consult Streator, M. L., ‹The Anglo-Alliance in Prophecy, or the Promises to the Fathers› (2 vols., New Haven, Conn., 1900). The relation of the lost 10 tribes to the «white» Indians of North America, reputed descendants of Madoc (q.v.), the Welsh prince who with his followers, according to tradition, emigrated to America in 1170, has also been a source of fruitful discussion, for which consult Henshaw, H. W., «Popular Fallacies respecting the Indians» (in *American Anthropology* n. s. Vol. VII, pp. 104–113, 1905); Mooney, J. (in *American Anthropology* Vol. IV, pp. 393–394, 1891); Mallery, G., ‹Israelite and Indian: A Parallel in Planes of Culture› (in ‹Proceedings› of American Association for the Advancement of Science, Vol. XXXVIII, pp. 287–331, 1889); The ‹Book of Mormon› (q.v.) (1830) is typical of a recurrent phase of the theory.

LOT, according to the book of Genesis, the son of Haran, and the nephew of Abraham. In order to avoid dissensions between his followers and those of Abraham, he went east into the plain of Jordan, toward Sodom, while his uncle dwelt in Canaan. After being taken captive by some marauders (styled kings in Gen. xiv), Lot was delivered by Abraham. Having received two angels into his house in Sodom, an attack was made upon it by the inhabitants, who were struck blind, and the impending destruction of the city was announced to Lot. He escaped with his family; but his wife, looking back, «became a pillar of salt.» The name «Lot's wife» is still given to a detached pillar about 40 feet high, on the Jebel Usdûm, a height near the Dead Sea. According to Genesis xix, 31–38, from Lot's incestuous intercourse with his daughters originated the Moabite and Ammonite nations.

LOT (ancient *Loda* or *Olitis*), France, one of the largest tributaries of the Garonne River, rises at Mount Lozère, one of the Cevennes, near Mende, department of Lozère. It flows west by south across the departments of Lozère, Aveyron and Lot, and joins the Garonne at Aiguillon, in the department of Lot-et-Garonne. Total course about 250 miles, of which 180 miles, commencing at Entraigues, are navigable.

LOTA, Chile, a city in the province of Concepción, situated on Arauca Bay, lat. 37° 5′ S. At present the centre of Chilean coal mining, it was a fishing village until 1852, when the Cousiño family demonstrated the existence of coal there in paying quantities. The Compañía Esplotadora de Lota y Coronal, formed and controlled by the same family, with capital of about $20,000,000, has mines at Playa Negra, Coronal and Buen Retiro, in addition to those at Lota. Undersea and underground galleries in the Lota mines have electric lighting and tramways. The company controls also the Lota copper-smelting, pottery, bottle and fire-clay-brick works, and a fleet of coasting steamers and sailing vessels. It provides for its workpeople free housing, schools, coal, medical attendance, hospitals and almshouses, a church and chaplain. A part of the Cousiño fortune has been employed in the creation of the famous park above the town, containing trees and plants from all quarters of the globe, the statue of Caupolicán, by Nicanor Plaza, etc. Pop. about 15,000.

LOTHAIR (lō-thār′) **I,** Roman emperor, eldest son of Louis-le-Debonnaire: b. about 795; d. Prüm, Prussia, 29 Sept. 855. He became associated with his father in the government of the empire in 817 and was crowned and named king of the Lombards in 820 and emperor in 823. On his father's death Louis and Charles, his brothers, joined their forces and defeated him at Fontenoy in June 841. In 843 the three brothers concluded the noted treaty of Verdun, by which Lothair retained the title of emperor, with Italy, and some French provinces beyond the Rhine and the Rhone. Charles then became king of France and Louis received a tract of country bordering on the Rhine.

LOTHAIR II, called THE SAXON, Roman emperor: b. about 1060; d. near Trent, 4 Dec. 1137. He became Duke of Saxony in 1106 and was elected king of Germany in 1125, and crowned by Pope Innocent II in 1133. By his performing certain acts of homage to the Pope, the claim was made that the empire was a fief of the Holy See. It was during his reign that the Diet of the empire claimed for itself the sole right to levy taxes, and to have in its hands the issues of peace or war.

LOTHAIR, a novel by Benjamin Disraeli, published in 1870. The scene of this extravagant, but remarkable, story is laid chiefly in England about the period of its publication. The hero, Lothair, a young nobleman of wide estates and great wealth, has been surrounded by a Protestant atmosphere. When, in accordance with his father's will, he goes to Oxford to complete his education, his other guardian, Cardinal Grandison, determines to bring him into the Roman Church. The story is a graphic description of the struggles of rival ecclesiastics, statesmen and leaders of society to secure the adherence of the young nobleman.

LOTHROP, Amy. See WARNER, ANNA BARTLETT.

LOTHROP, Harriet Mulford Stone, «MARGARET SIDNEY,» American writer for young people: b. New Haven, Conn., 4 Oct. 1844. She was married to the Boston publisher, D. Lothrop, in 1881, and was founder and president of the National Society of the Children of the American Revolution. Among her numerous publications, mainly for young people, may be cited ‹The Five Little Peppers› series (1882–1907); ‹So As by Fire› (1881); ‹The Pettibone Name› (1883); ‹The Golden West› (1885); ‹The Minute-Man› (1886); ‹Dilly and the Captain› (1887); ‹Little Maid of Concord Town› (1898); ‹The Judge's Cave: a Romance of the Days of Regicides›; ‹Little Maid of Boston Town,› etc. She was also a constant contributor to the leading juvenile periodicals. Her ‹Works› in 12 volumes were issued at Philadelphia in 1914.

LOTI, lō'tē, **Pierre,** pen-name of LOUIS MARIE JULIEN VIAUD, French author: b. Rochefort, 14 Jan. 1850. After a school education in his native town he entered the French navy in 1867, becoming midshipman in 1873, and resigning in 1898 with the rank of lieutenant. He has seen, in the course of his calling or otherwise, a great part of the world, and descriptions of foreign scenery figure largely in his works. He served with distinction in the Tonkin campaign, but incurred official displeasure by describing the cruel proceedings of French soldiers at Hué in a series of letters to the *Figaro* in 1883. In 1887 he was honored by admission into the Legion of Honor, and in 1891 was elected a member of the Academy, Zola being a rival candidate on the occasion. He has published many stories, tales and sketches under the pseudonym «Pierre Loti,» among them being ‹Aziyadé› (1879); ‹Rarahu› (1880), reprinted in 1882 as ‹Mariage de Loti›; ‹Le Roman d'un Spahi› (1881); ‹Fleurs d'Ennui› (1882); ‹Pêcheur d'Islande› (1886), his chief work; for which he received the Prix Vitet from the Academy; ‹Madame Chrysanthème› (1887); ‹Japonneries d'Automne› (1889); ‹Au Maroc› (1890); ‹Le Roman d'un Enfant› (1890); ‹Fantôme d'Orient› (1892), a sequel to ‹Aziyadé›; ‹Le Désert› (1894); ‹Jérusalem› (1895); ‹La Galilée› (1895); ‹Ramuntcho› (1897); and ‹Figures et Choses qui Passaient› (1898). Many of these have been translated into English. His works are in general of an exotic character, dealing predominantly with the East, which he had studied during his naval service. (See THE ICELAND FISHERMAN). Consult Lemaitre, ‹Contemporains› (Vol. III, 1888); Doumic, ‹Ecrivains d'aujourdhui› (1894).

LOTION, a wash, solution or medicinal mixture for external application to the body; usually a liquid remedy, consisting principally of water, as a menstruum, and applied to circumscribed portions of the skin, or of the mucous surfaces. Lotions are either cooling, stimulating, astringent, soothing or sedative. Water combined with spirit or vinegar is an example of the first. The spirit is added to the water in the proportion of half an ounce and upward to the half-pint. The lead lotion is at once cooling and astringent. A good stimulating lotion is procured from a mixture of water with a third or a half of its bulk of spirit of wine, which is applied to the skin by means of lint, and covered to prevent evaporation. Astringent lotions are formed by adding from 1 to 10 grains of sulphate of zinc or of white vitriol to an ounce of very cold water, having other astringents in solution. Soothing lotions consist of the various preparations of opium, of the decoction of poppies, hemlock, etc., and prussic acid is employed in the preparation of sedative lotions. Stimulating lotions are applied to indolent ulcers and tumors, and sedative and narcotic mixtures are employed to alleviate pain. A fomentation is a lotion used hot. So-called antiseptic lotions contain bichloride of mercury, or carbolic acid, or boracic acid.

LOTOPHAGI. See LOTUS-EATERS.

LOTTA. See CRABTREE, CHARLOTTE.

LOTTER (lŏt'tėr) **FAMILY,** a family of printers in Germany, the founder of which, Melchior Lotter, born at Aue, appeared in Leipzig about 1491. There his publications of breviaries and missals brought him reputation, which his larger enterprises extended. He published ‹Persius› (1512); ‹Horatii Epistolæ› (1522); ‹Lutheri Tessaradecos Consolatoria pro Laborantibus› (1520), etc. One of his innovations was the reservation of Gothic types for German and use of Roman for Latin. He is supposed to have given at least secret sympathy and aid to the Reformation. His son, Melchior, who died about 1540, was the original printer of Luther's Bible (1522–24), and was succeeded by Hans Lufft (q.v.). His publications also included various works of Luther, Melanchthon and other writers.

LOTTERY, a public gambling scheme, by which, for a valuable consideration, one may by favor of the lot obtain a prize of a value superior to the amount or value of that which he risks. In its best and most frequent application, the word describes those schemes of this nature which are conducted under the supervision and guaranty of government, and the proceeds of which are devoted to public objects. Almost all modern states have, at some period of their history, employed lotteries as a means of revenue. But though they supply a ready mode of replenishing the public treasury, they have always been found to exert a mischievous influence upon the people. The poor are invited by them rather than the rich. They are diverted from persistent labor and patient thrift by the hope of sudden and splendid gains; and as it is the professed principle of these schemes to withhold a large part of their receipts, a necessary loss falls upon that class which can least afford to bear it. Between the years 1816 and 1828 the French government derived from lotteries an annual income of $2,400,000. Some years later the government suppressed them, and in January of the next year $110,000 more were found, to be in the savings banks of Paris alone than in the same month of the preceding year. In France of to-day the lottery is used to secure state and municipal bonds at a low rate of interest — some of those investments being subscribed 20 times over. Each subscriber gets a lottery bond, with prizes drawn four, six or eight times a year, and every care is exercised in the drawings for prizes. In several other European states government lotteries are still maintained. They have become an almost indispensable source of revenue; and they are defended by the argument that as the passion for play is irrepressible among the people, and their money would otherwise be invested in foreign or in secret and less fairly managed schemes, the state may well assume the conduct of lotteries at home; that under its supervision the evils attendant upon them are diminished, and their earnings are devoted to the public welfare. Dice for the casting of lots have been found in ancient Egyptian and Assyrian tombs. The lot is frequently mentioned in the Bible as a means of settling disputes and partitioning land. One of the Apostles, Matthew, was chosen by lot. Venetian and Genoese merchants are known to have got rid of surplus stock by lottery. The first recorded public lottery was held at Bruges in 1446. The first in England was drawn in 1569; they were finally abolished in 1826.

In the United States, the lottery has been from the earliest settlement of the country a familiar means of raising funds, which in this country could have been secured in no other mode so easily, if at all. The Virginia company derived a large profit from English lotteries, and the influence of them extended gradually to the Eastern colonies; for it is reported that an assembly of ministers at Boston in 1699 denounced the lottery as «a cheat,» and its agents as «pillagers of the people.» Generally, however, lotteries enjoyed a fair reputation and certainly were soon extensively employed throughout the country. In the 18th century they were extraordinarily popular in America. Legislatures authorized lotteries for every species of public improvement, for the building of churches and colleges, for the repair of losses to individuals by fire and otherwise; for example, Faneuil Hall, after the fire of 1761, was rebuilt by lottery. The Continental Congress tried to raise money by lottery in 1777.

In 1833 a society was formed in Pennsylvania which advocated their suppression. In July 1834 the society issued an address to the public, setting forth its objects and views. It was the educative work of this society that first arrested public attention to the evils inherent in lottery systems, and it has been followed by legislative action. Lotteries are now prohibited in all the States and Territories of the United States; in Massachusetts raffling is forbidden by express statute. The schemes known as art unions are held to be lotteries by express decisions. In the language of the court in New York: «These associations distribute a small number of prizes among a great number of persons. The prizes and blanks are drawn in the same manner as in other lotteries. The intention of these schemes is to sell works of art for more than they can be sold for at private sale, and this is to be brought about by an appeal to the universal passion for playing at games of chance. They have all the attributes and elements of lotteries.»

The sums annually employed by Americans in lottery speculations probably amounted to hundreds of thousands. The last lottery supported by governmental encouragement was the Louisiana State Lottery. An Act of Congress passed in 1890 attempted to crush it by forbidding it the use of the United States mails, which act compelled its removal to Honduras, where in 1903 it was still in existence, and thousands of tickets for this lottery were sold monthly in the United States, particularly on the Pacific Coast, where as late as November 1903 the daily newspapers issued «extras» giving the winning numbers in the drawings of the Honduras company. Consult Ashton, J., ‘History of English Lotteries’ (London 1893); Palgraves, ‘Dictionary of Political Economy’ (ib. 1896); Ross, A. F., ‘History of Lotteries in New York’ (in *Magazine of History*, New York 1907); Spofford, in the ‘Annual Report of the American Historical Association’ (Washington 1892); Van Vorst, ‘Naples and the Lotti,’ (in *Harpers'* for September 1910); and ‘Report of the Joint Committee on Lotteries to the British Parliament’ (London 1908).

LOTTO, a game having its origin in Italy but now played occasionally in other countries. It is played on boards, divided into 27 small squares arranged in three horizontal rows; five squares in each row are marked with numbers between 1 and 90, four of the squares being left blank. Each person playing is provided with a board upon which he covers the space marked with the particular number called out by the dealer, who draws the counters from a bag. The player who first covers all the five numbers on any horizontal row is declared the winner.

LOTUS, in art, the lotus played an important part in the art of the ancients. It is common in all Egyptian decoration, especially in borders. It was not unknown in the art of the Assyrians and Persians and from all these sources it was derived by the Greeks and made familiar to the West by the Romans. Some scholars unduly overrated its importance and frequency in Egyptian ornament, ascribing to it a kind of solar symbolism; this is denied by others of equal authority. Consult Goodyear, W. H., 'Grammar of the Lotus' (London 1891) and Flinders Petrie, W. M., 'Egyptian Decorative Art' (ib. 1895).

LOTUS-EATERS (Latin *Lotophagi*), in ancient Greek legends a people on the north coast of Africa who lived on the fruit of the lotus-tree. According to Homer they received Ulysses and his followers hospitably, but the sweetness of the fruit induced such a feeling of happy languor that they forgot their native land and ceased to desire to return to it, their sole object being to live in delicious dreamy idleness in Lotusland. See Lotus.

LOTZE, Rudolph Hermann, German philosopher and physiologist: b. Bautzen, Saxony, 21 May 1817; d. Berlin, 1 July 1881. He studied philosophy and medicine at Leipzig and in 1842 was appointed extraordinary professor of philosophy in that university and in 1844 ordinary professor in Göttingen. In 1881 he filled the same chair in Berlin. His philosophical position is that of a teleological idealist, and he makes metaphysics to be destitute of all independent existence, apart from ethics. The universe has its cause in the notion of the Good, which underlies all the phenomena and activities of the world. His position as a teleologist is the same as that of Asa Gray, and while allowing that mechanism obtains in the movements of the universe he denies that this excludes the possibility of creative design. Lotze is, however, considered to have done his most original work in the domain of psychology. He teaches that our space-consciousness is built out of the distinctive, non-spatial sense-attributes, which vary according to the locality of the sense-organs stimulated. Among his works are 'Metaphysik' (1841); 'Logik' (1843); 'Mikroskosmus' (1856–64); and 'Geschichte der Æsthetik in Deutschland' (1868). Consult Falckenberg, 'Hermann Lotze' (Stuttgart 1901); Hall, C. S., 'Founders of Modern Philosophy' (New York 1912); Hartmann, 'Lotze's Philosophy' (Leipzig 1888); Jones, H., 'Critical Account of the Philosophy of Lotze' (Glasgow 1895).

LOUBAT, Joseph Florimond, zhŏ-zef flō-rĭ-mônd loo-bä, Duc de, French author and philanthropist: b. New York, 21 Jan. 1831. He was graduated from the University of Paris and has been a liberal giver to public institutions, among his benefactions of this character being a gift of $1,000,000 to Columbia University, including valuable books and manuscripts. He has likewise given much to the Roman Catholic Church, and in recognition of this fact received his title of Duc de Loubat from Pope Leo XIII in 1893. He has written 'Narrative of the Mission to Russia in 1866 by G. V. Fox'; 'Medallic History of the United States.'

LOUBET, loo-bā, **Emile François,** French statesman: b. Marsanne (Drôme), 1838. He was graduated in law at Paris, in 1865 was admitted to the bar at Montélimar, attracted attention by his legal ability, became counsel for the Paris, Lyons and Mediterranean Railway, in 1869 was elected conseiller d'arrondissement, and 4 Sept. 1870 was chosen mayor of Montélimar. Elected in 1871 to the general council of the Drôme, of which he afterward (1885) became president, he was returned to the Chamber of Deputies for Montélimar in 1876, where he served with the Republican left until 1885. In 1885 he entered the Senate for the department of Drôme, and from December 1887 until April 1888, when he retired with his colleagues of the ministry, filled with much credit the post of Minister of Public Works in the Tirard Cabinet. He was chairman of the Finance Committee of the Senate in 1890, chairman of the Customs Committee in 1893; and on 29 Feb. 1892 was made Premier by President Carnot. His Cabinet, in which he held the portfolio of the Interior, lasted until November of that year, when its retirement was caused by attacks on its supposed laxity in the prosecution of the Panama case. In 1896 he was chosen president of the Senate. Upon the sudden death of President Faure (16 Feb. 1899), the National Assembly met in congress (18 February) and elected Loubet President of the Republic on the first ballot. His position in politics is that of a moderate Republican, without the tendency to Radical views sometimes ascribed to him. He has been not only a skilful administrator, but a close student of economic questions. He is a protectionist, though not of the extreme type, and an advocate of economy in finance, having made an able speech on financial reform in 1895. His administration as President did much to strengthen the Republicans, and the Monarchist party has almost entirely disappeared as a serious factor in national affairs. Among the events of his term were the trial of Captain Dreyfus at Rennes and the remission of the 10 years' sentence there passed upon him; the strike of the miners at Montceau and of the dock-workers at Marseilles; the complete separation of Church and State and the disturbances attendant on the passing of the law of the associations; and the conclusion of an entente with England, which left France a free hand in Morocco in return for non-intervention in Egypt. In 1906 he was succeeded in the Presidency by Clément Armand Fallières (q.v.). See France — History.

LOUDON, low'dŏn, **James,** Canadian physicist: b. Toronto, 1841. He received his education at the College of Upper Canada and at Toronto University. In 1862 he was appointed instructor in classics at the latter institution and subsequently became assistant professor of mathematics. From 1875 to 1887 he held the chairs of mathematics and physics and from 1892 to 1906 was president of Toronto University. In 1872 he was one of the original Fellows of the Royal Society of Canada and was its president in 1901–02. He is a member of several learned societies. His publications include papers in the 'Transactions' of the Canadian Institute, the *American Journal of Mathematics,* the *Philosophical Magazine,* etc., and the volume 'Elements of Algebra' (1873).

LOUDON, Fort, a name given to two forts built during the Colonial period, and intended for defense against the Indians. One, built in 1750, was in Loudon County, Tenn., on the Tennessee River. An Indian massacre took place here a few years after the erection of the fort. The other Fort Loudon was erected in 1752, near Winchester, Va. It was a square building with four bastions, mounting 24 guns. It was large enough to accommodate nearly 500 men.

LOUGHBOROUGH, lŭf'bŭr-ō, England, market town and municipal borough of Leicestershire, on the Loughborough Canal, and the Great Central, the London and Northwestern and the Midland railways. It contains a 14th century church (restored) and several modern churches, a grammar school, free library, town and county halls, etc. It has hosiery, engineering, iron and dye works and bell foundries. The town has undergone extensive improvements. There is a fine public market, and the water, gas and electric plants, market, cemeteries and allotment gardens are municipally owned. Garbage and waste are used to generate steam for pumping the sewage, which is utilized on farms. Loughborough (Lucteburne) was given by William the Conqueror to Hugo Lupus. Pop. 23,000. Consult Fletcher, W. G. D., ‘Chapters in the History of Loughborough’ (1883).

LOUGHEAD, lō'hĕd, **Flora Haines,** American novelist and journalist: b. Milwaukee, Wis., 12 July 1855. She was graduated from Lincoln University, and was married in 1875 to C. E. Apponyi, and in 1886 to John Loughead, a journalist. She has done much journalistic work in Chicago, Denver and San Francisco, and is the author of ‘The Libraries of California’ (1878); ‘The Man Who Was Guilty’ (1886); ‘Handbook of Natural Science’ (1886); ‘Quick Cooking’ (1890); ‘The Abandoned Claim’ (1892); ‘The Man from Nowhere’ (1892); ‘Santos's Brother’ (1892); ‘A Crown of Thorns’ (1892); ‘The Black Curtain’ (1897); ‘The San Franciscan’; and of several plays. She edited the ‘Biography of Oscar Lovell Shafter’ (1915).

LOUGHREA, loch'-rē-ą, Ireland, market-town and episcopal seat in County Galway, on the north shore of Lough Rea, and on the Midland Great Western Railway, 20 miles east by south of Galway and 116 miles west of Dublin. It contains the magnificent cathedral of Saint Brendan, erected 1900–05, and is the seat of the Roman Catholic bishop of Clonfert. Near the railway station are the remains of an early English Carmelite friary (about 1300) which survived the Dissolution. It was founded by Richard de Burgh, part of whose castle also survives. The town was once fortified and parts of the old ramparts remain. Later it was a military station; the military barracks still remain. The town has a large trade in farm produce; a great market is held every Thursday. Lace-making is the chief industry, and is of small proportions. During the Agrarian strife, Loughrea was the scene of several disturbances. Pop. 3,100.

LOUGHRIDGE, loch'ridj', **Robert McGill,** American Presbyterian clergyman, missionary and lexicographer: b. Laurensville, S. C., 24 Dec. 1809; d. Waco, Tex., 8 July 1900. His father, James Loughridge, was a native of County Antrim, Ireland, and his mother, Deborah Ann (McGill) Loughridge, was a native of South Carolina and of Scotch-Irish extraction. His parents removed to Eutaw, Ala., in his early youth. Robert M. Loughridge was educated at Miami University, graduating in 1837. He then entered Princeton Theological Seminary, but remained only one year, the death of his father necessitating his return home to aid his mother in the management of the family's affairs. He continued to pursue his theological studies under the direction of his pastor, Rev. Dr. John H. Gray. He was licensed to preach by the Presbytery of Tuscaloosa, in 1841. In October 1842 he was ordained by the same Presbytery being under appointment of the Presbyterian Mission Board as a missionary to the Creek Indians. He went to the Creek Nation only five years after the people of that tribe had expelled all missionaries. When he presented himself before the Creek Council and asked permission to take up his work it was granted with great reluctance and he began the organization of the mission at Coweta, in February 1843, where a school was established. Six years later, his work had so prospered that the Creek Nation founded a manual labor school at Tullahassee, of which he was made superintendent, and where he continued to labor until the work of the mission was interrupted by the outbreak of the Civil War. Mr. Loughridge then moved to Texas, where he engaged in pastoral work until 1880, when he returned to the Creek Nation to accept the superintendency of the new manual labor school at Wealaka, in which capacity he continued to labor until his final retirement in 1892, after having reached the age of 82. He mastered the Creek or Muskogee language, translating the catechism, portions of the Bible and many hymns into that tongue and also compiling a Creek-English dictionary, which, however, was not printed until after his death.

LOUIS, loo'is (Fr. loo-ē), called THE CHILD, king of Germany: b. 893; d. 911. He was the son of the Emperor Arnulphus, and succeeded him in 899. During his nominal kingship the government was mainly conducted by Archbishop Hatto of Mainz. At this time the empire was constantly ravaged by the Hungarians. He was the last prince in Germany of the Carlovingian race.

LOUIS I, surnamed LE DEBONNAIRE, Roman emperor: b. 778; d. near Mainz, Germany, 20 June 840. He was the 3d son of Charlemagne, was early appointed by his father king of Aquitania, and in 813 was named joint-regent of France, of which, in the following year, he became sole sovereign, as well as emperor of the West. In 817 he divided his dominions among his three sons, Lothair, Pepin and Louis, and thereby gave rise to disturbances and contests which lasted during the whole period of his reign. In 829, in consequence of the solicitations of his second wife, Judith of Bavaria, who had borne him a son, Charles the Bald, he made a new division of the empire. In 830 the brothers Lothair and Pepin combined against their father, took him prisoner, charged their stepmother with adultery, and shut her up in a monastery. The design of Lothair to make himself sole sovereign having been discovered, the Diet of Nimeguen obliged him to submit at discretion. Strife continued for the rest of Louis' life. In 837 Louis made a new division in favor of Charles, who obtained Neustria in addition to Aquitania. Though not without good qualities Louis had neither the statesmanship nor decision necessary for ruling so large an empire. He was succeeded as emperor by Lothair, to whose protection he had recommended his favorite son, Charles.

LOUIS II, Roman emperor: b. about 825; d. Brescia, 12 Aug. 875. He was the son of Lothair I, was made king of the Lombards in 844, and became emperor, in succession to his father, in 855. He was an able ruler, who contended victoriously against the Saracen invaders of southern Italy.

LOUIS III, Roman emperor, surnamed The Blind: b. about 880; d. 928. He was the son of Boson, king of Province, and Ermengarde, daughter of the Emperor Louis II. He succeeded his father on the throne of Provence at the age of 10, and in 900 contested the imperial throne with Berengar I. Berengarius forced him to leave Italy, and take oath never to return. In 904 he returned and won some successes; but Berengarius surprised and took him prisoner at Verona in 905, and deprived him of his sight.

LOUIS IV, surnamed the Bavarian, Roman emperor: b. 1287; d. near Munich, 11 Oct. 1347. He was the son of Louis the Severe, Duke of Bavaria, and succeeded his father in the dukedom in 1294 and was elected emperor in 1314. Frederick le Bel of Austria was also chosen at Cologne by a minority of electors, and a war between the rivals ensued. Frederick was taken prisoner in 1322, and only gained his liberty by renouncing his claims. Pope John XXII then issued his bull of deposition against Louis, and the latter, appealing to a general council, went to Italy, where he declared the deposition of John and set up Peter de Corbière as Pope under the name of Nicholas V, by whom he was crowned at Rome. In 1338 the German electoral princes in a council at Rhense announced that the emperor's title to the German and imperial crowns were derived from his election by them and required no further sanction from the Pope, the validity of which proceeding was not recognized by the papacy.

LOUIS I, king of France. See Louis I, Roman emperor.

LOUIS II, surnamed Le Bègue (the Stammerer), king of France: b. 846; d. Compiègne, France, 10 April 879. He was the son of Charles the Bald, was crowned king of Aquitaine in 867 and succeeded his father on the throne of France in 877. He was obliged to deliver up Provence to Boson, by whom it was erected into a kingdom. His children, Louis and Carloman, divided the kingdom between themselves and a posthumous son, afterward known as Charles the Simple.

LOUIS III, king of France: b. about 863; d. 882. He was the son of Louis II and the brother of Carloman, with whom he divided the rule of the kingdom. He defeated Hugh the Bastard, son of Lothair, marched against Boson, king of Provence, and successfully opposed the Normans at Saucourt (3 Aug. 881), a battle celebrated in the famous German poem, the 'Ludwigslied' and in the 'Chanson du roi Louis.'

LOUIS IV, surnamed D'Outremer («from beyond the seas»), king of France: b. 921; d. September 954. He was the son of Charles the Simple, was educated at the court of King Athelstan of England, and became king in 936, on the death of Rudolph of Burgundy. He invaded Normandy, but was defeated and taken prisoner in 944. He was set free the next year after being obliged to concede Normandy to Richard, son of Duke William, and Laon to Hugh, father of Hugh Capet, the latter being, however, restored.

LOUIS V, surnamed Le Fainéant (Do Nothing), king of France: b. 966; d. May 987. He was the last French monarch of the Carlovingian dynasty. In spite of the name conferred upon him he was an active ruler. He succeeded his father, Lothair, in 986, and soon after becoming king took the city of Rheims and was preparing to march to the assistance of the Count of Barcelona, hard pressed by the Saracens, when he is said to have been poisoned by his mother. Consult Lot, 'Les derniers Carolingiens: Lothair, Louis and Charles' (Paris 1891).

LOUIS VI, surnamed Le Gros (the Fat), king of France: b. 1081; d. 1 Aug. 1137. He was the son of Philip I, with whom he was associated in the government in 1100, and whom he succeeded in 1108. His reign was greatly disturbed by contests with the Normans, and by wars among his turbulent vassals in the Isle de France. He quarreled with Henry I of England, and thus was begun the struggle between the English and the French, which continued three centuries. He was a benefactor of the Church and of the poor. He was ably counseled by his minister, Abbé Suger. Consult Luchaire, 'Louis VI le Gros' (Paris 1889); Thompson, J. W., 'Development of French Monarchy under Louis VI le Gros' (Chicago 1895).

LOUIS VII, called Le Jeune, king of France: b. about 1120; d. 18 Sept. 1180. He was the son of Louis VI, and succeeded him in 1137. He contested with Pope Innocent II the right of presentation to benefices, and was excommunicated by Innocent and his kingdom placed under interdict. By the persuasions of Saint Bernard, Louis embarked on the Second Crusade, but was defeated by Saladin, and while returning to Europe was captured at sea by the Greeks, but afterward rescued by Roger, king of Sicily. His divorced queen, Eleanor of Aquitaine, married Henry of Normandy, afterward Henry II of England, bringing with her as dowry the provinces of Poitou and Guienne. This caused a long war between England and France. Consult Luchaire, 'Etudes sur les actes de Louis VII' (Paris 1885); Hirsch, 'Studien zur Geschichte König Ludwigs VII von Frankreich' (1892); Lavisse, 'Histoire de France' (Vol. III, Paris 1901).

LOUIS VIII, surnamed The Lion, king of France: b. 1187; d. Montpensier, Auvergne, France, 8 Nov. 1226. He was the son of Philip Augustus of France and married Blanche of Castile in 1200. Accepting the offer of the English crown made him by the English barons, in 1216 he landed in England, took Rochester and Winchester, and received the homage of the barons at London. After the death of John and the accession of Henry III he was defeated at Lincoln, signed the Peace of Lambeth in 1217 under which he received a small indemnity. He was excommunicated by the legate and withdrew to France in September

1217. He succeeded his father in 1223, and soon regained most of the English possessions in France. In 1226 he led a crusade against Raymond, Count of Toulouse, and the Albigenses; took Avignon after a three months' siege, and laid waste Languedoc. Consult Petit-Dutaillis, 'Etude sur la vie et la règne de Louis VIII' (Paris 1894).

LOUIS IX, called Saint Louis, king of France: b. Poissy, France, 25 April 1214; d. near Tunis, Africa, 25 Aug. 1270. He was the son of Louis VIII and Blanche of Castile, and came to the throne on the death of his father. Being only in his 12th year he was placed under the guardianship of his mother, who was made regent of the kingdom, and he was declared of age in 1236. In 1243 Louis defeated the English in several engagements, and a truce for five years was concluded. Having made a vow, in the event of recovering from a dangerous disease, to march against the infidels in the Holy Land, he in 1248 embarked at Aigues-Mortes with an army of 50,000 men. This expedition proved disastrous, and Louis with his army was captured by the Saracens. Damietta, which had been taken by the French, was demanded as the price of the monarch's freedom, and a vast ransom was also claimed for his followers. In 1254 he returned home, and in the interval Queen Blanche, who had ruled the kingdom well in his absence, had died. Louis now turned his attention to the administration of the law. The subjects were now suffered to appeal from the decision of their lords to four royal tribunals, and men of learning were introduced into the Parliament. Louis also diminished the taxes and he founded the Sorbonne. The code of laws known as the 'Etablissements de Saint Louis' is the work of some unknown compiler. In 1270 he undertook a crusade against Tunis, in the midst of which enterprise he died. He was succeeded by his son Philip III. He was canonized by Boniface VIII in 1297. The Sieur de Joinville wrote his life, of which an English translation by Hutton appeared in 1868. Consult Berger, 'Saint Louis et Innocent IV' (Paris 1893), and 'Histoire de Blanche de Castile' (ib. 1895); Faure, 'Histoire de Saint Louis' (2 vols., Paris 1866); Lavissè, 'Histoire de France' (Vol. III, Paris 1901); Lecoy de la Marche, 'La France sous Saint Louis' (ib. 1893); Perry, F., 'Saint Louis the Most Christian King' (New York 1901); Sepet, 'Life' (Paris 1903).

LOUIS X, surnamed Le Hutin (the Quarreler), king of France: b. Paris, 1289; d. Vincennes, 4 June 1316. Through his mother he inherited the kingdom of Navarre in 1305, and in 1314 he succeeded Philip the Fair, his father, on the throne of France. His posthumous son, John I, survived but a few months, and Louis' brother then succeeded as Philip V.

LOUIS XI, king of France: b. Bourges, France, 3 July 1423; d. Plessis-les-Tours, France, 30 Aug. 1483. He was the son of Charles VII, but in all respects very unlike him, and in 1440 he left the court and headed an insurrection against his father. Charles pardoned his son but the latter soon entering into new conspiracies was obliged to take refuge in Burgundy, and lived there five years in a dependent condition. On reaching the throne after the death of his father, in 1461, he dismissed the former ministers and surrounded himself with obscure men, having neither character nor talents to recommend them. In all his acts a crooked policy and sinister views were evident. Pretending to reconcile contending parties, he secretly instigated them against each other, and when negotiating with a foreign government he bribed its messengers and established secret correspondences with them. He carried on a war with Charles the Bold, afterward Duke of Burgundy, which lasted 1465–72, and on the death of Charles in 1477, at the battle of Nancy, he joined Burgundy to France. In 1481 he united Anjou, Maine and Provence to the kingdom. Louis both reigned and governed, and was inflexible in his purposes. He vanquished the feudal lords, put an end to anarchy, consolidated the central power, artfully played off the cities against the nobility and was implacable in his revenges. He greatly improved the means of communication. Until his last years he had no regard for the appearances of power, and dressed meanly. His later years were spent in the dread of death; he lavished gifts upon the saints, and spent his time in ascetic practices which failed to bring relief to his tortured mind. Consult 'Louis XI et les villes' (Paris 1893); Hare, C., 'Louis XI' (London 1907); Kitchen, 'History of France' (Vol. I, Oxford 1885); Lavissè, 'Histoire de France' (Vol. IV, Paris 1902), and, for its vivid presentation of the king, Scott's 'Quentin Durward.'

LOUIS XII, surnamed the Father of His People, king of France: b. Blois, France, 27 June 1462; d. 1 Jan. 1515. He was the son of Charles, Duke of Orleans, and on coming to the throne in 1498 he pardoned all who had wronged him previously. His reign was continually disturbed by war. He subdued the Milanese, Genoa and Naples. His joining of the League of Cambrai (1508) enabled him to conquer Venice; but the Holy League was formed against him in 1511; and in 1513 the French were expelled from Italy. Henry VIII of England, a member of the league, attacked Louis in his own dominion and he was obliged to sue for peace after the battle of the Spurs in August 1513. For his third wife he married the young Princess Mary, sister of Henry VIII, who after his death was married to her first lover, Charles Brandon, Duke of Suffolk. Louis XII was honest and magnanimous; he was friendly to science, and France prospered under him and his able chancellor, Cardinal d'Amboise. Consult Clavière, 'Histoire de Louis XII' (Paris 1890 et seq.); Hauser, 'Les sources l'histoire de France XVIe siècle' (ib. 1906), and Lacroix, 'Louis XII et Anne de Bretagne' (1882).

LOUIS XIII, king of France: b. Fontainebleau, France, 27 Sept. 1601; d. Saint Germain-en-Laye, France, 14 May 1642. He was the son of Henry IV, whom he succeeded under the regency of his mother, Mary de Medicis, and who made alliances with Spain and the Pope. In 1614 he was declared of age and the next year he married Anne of Austria who after 23 years of married life gave birth to a son, afterward Louis XIV. The realm at the beginning of his reign was in a very disturbed state. The Huguenots were threatening and a great part of the kingdom rebelled. In 1624

Louis chose Cardinal Richelieu as his Prime Minister, and the remainder of his reign was to all purposes that of the great cardinal. Under him the Huguenot power was broken by the capture of La Rochelle in 1628. The governmental power centralized and the influence of Austria materially weakened. In the Thirty Years' War he supported Gustavus Adolphus and the Dutch against Spain and Austria. During his reign the *Etats généraux* — a body more ancient than the parliaments — met for the last time till the reign of Louis XVI. Consult Patmore, K. A., 'The Court of Louis XIII' (London 1910); Raumer, 'Geschichte Ludwigs XIII und des Kardinals Richelieu' (1830); Topin, 'Louis XIII et Richelieu' (1876); Zeller, 'La Minorité de Louis XIII' (1897). See RICHELIEU.

LOUIS XIV, king of France: b. Saint German-en-Laye, 5 Sept. 1638; d. Versailles, 1 Sept. 1715. He was only five years old when he succeeded to the throne, but his mother, Anne of Austria, was made regent during his nonage which ended in 1651, when he was 13. Cardinal Mazarin was then Prime Minister, and the French army under the leadership of Condé and Turenne was gaining much glory in the war with Spain and the emperor. But internally the nation was in the throes of a civil war; Mazarin's avarice and the peculations of Fouquet had disgusted the Parisians, who were moreover incensed with Anne of Austria's conduct of the regency and the supremacy of her agent the cardinal. The king and his mother were compelled with the unpopular Prime Minister to flee from the capital, and the Spanish armies streamed over the northeast boundaries from Holland and held their way victoriously through Champagne and Lorraine. When war broke out between England and Holland, Louis threw his strength on the side of the latter; but the conflict was largely confined to the sea, and after a few sea fights the war was ended by the Peace of Breda in 1667. Mazarin had died in 1661, Fouquet was condemned to perpetual imprisonment after being compelled to disgorge his ill-gotten gains and when the king was asked who was to be referred to on matters of public business he astonished his courtiers by saying «Myself.» And indeed he reigned as absolute monarch to the end of his days. He appointed Colbert to take charge of the public exchequer, and the consequence was a multitude of needed reforms. He had forced the court of Spain as well as Pope Alexander VII to submit to his personal dictation and make ample reparation for the wrongs suffered by French ambassadors at the hands of Spaniards and Italians in foreign capitals; the king of England was his pensioner. All Europe was impressed by his bold self-assertion, and his well-known saying «*L'état c'est moi,*» «I am the state,» was felt to be literally true.

But the great desire of Louis was the attainment of military glory. When a child his chief amusement had been to turn his playmates into soldiers and engage in a mimic war. After his victorious campaign in Holland, closed by the Treaty of Nimeguen in 1678, he was acknowledged to be the leading sovereign in Europe. He had the most numerous, the best drilled, the best equipped army in the world. His diplomacy had triumphed in every court, and the French nation led Europe in art, science and letters, while trade and industry were amazingly flourishing; and he successfully established the liberties of the Gallican Church (1682). Louis shone among his ministers, generals and literary courtiers as the sun among the stars, an ideal king, a paragon of learning, strength and wisdom. At Versailles he built himself a palace at a cost of 150,000,000 francs. Here the splendor of his surroundings was the envy and admiration of all other monarchs. But his wisdom and political sagacity were much criticised when in 1685, under the influence of Madame de Maintenon, he revoked the Edict of Nantes by which the policy of Henry IV had made certain indulgences to Calvinists of France. By unsheathing the sword of religious persecution he drove away many citizens whose industrial skill and steady lives formed one of the stablest and most precious elements in French national life. Soon after this half of Europe formed a league against France. Holland, Germany and Spain joined their forces in an attempt to humble the overweening arrogance of a monarchy whose greatness was a menace to each of them. In 1688 the Dauphin took Philipsburg on the Rhine, but was forced to evacuate and retreat before the overwhelming forces of the allies. The war continued with varied fortunes until the Peace of Ryswick, 1697. The death of Charles II of Spain, the last of the house of Hapsburg (1700), brought on the war of the Spanish Succession. He left his crown to Philip of France, Duke of Anjou, who assumed the title of Philip V, but his claim was disputed by the Archduke Charles, who had the support of the emperor, as well as of Holland and England. In 1704 Prince Eugene and Marlborough routed the French forces at Blenheim, Barcelona surrendered to the Archduke Charles, Marlborough won the battle of Ramillies in 1706, and in 1708 that of Oudenarde. The fatal defeat of Malplaquet the following year decided the struggle in favor of the allies and the Peace of Utrecht (1713) completed the humiliation of France and added to the power and ascendancy of England. The treaty inflicted a heavy blow on French power in America, as under it Newfoundland, Acadia and Hudson Bay were ceded to England. France was, however, saved from dismemberment, mainly through the boldness and vigor of Louis and his counsellors, and the principal foreign conquests of the king were not forfeited. For the two remaining years of his reign the country enjoyed tranquillity. Louis in his declining years expressed regret for the distress he had brought on his well-loved country by his love of foreign conquest and warlike glory. His unworthy private life had some part in rousing the remorse which tortured his last days, and caused him to show that spirit of piety and devotion which Lesage ridiculed as hypocrisy. His mistresses, La Vallière, Montespan, Fontanges and others had made his court a by-word of scandal. Madame de Maintenon, who was married to him a year after the death of his queen, Maria Theresa (1683), was influential in rousing his sense of past licentiousness. In this she was aided by the eloquence of Bossuet.

The reign of Louis le Grand was made brilliant by the great soldiers, sailors, literary men, artists and men of science who were his contemporaries. His reign has indeed been aptly styled the Augustan or golden age of France. Among his sea commanders were Château-Renand, Duquesne and Tourville; Vauban was his military engineer; Perault, Mansart and Blondel architects; among his painters were Claude Lorraine, Poussin and Lebrun; among poets and writers of his reign were Corneille, Racine, Molière; among his great preachers were Massillon, Bossuet and Flechier. He was worthy of the title of the Great Monarch for his strong and astute statecraft, the magnificence of his court, his dignity and munificence, and he fixed for the French monarchy that type of absolutism which Balzac has declared to be in France the safest and best foundation on which national greatness was to be developed.

Consult Barine, ‘Louis XIV et La Grande Mademoiselle’ (Paris 1905); Blennerhassett, ‘Louis XIV and Madame de Maintenon’ (London 1910); Bourgeois, E., ‘The Century of Louis XIV’ (Eng. trans. by Hoey, ib. 1895); Gérin, ‘Louis XIV et le Saint-Siège’ (Paris 1894); Hassall, ‘Louis XIV and the Zenith of the French Monarchy’ (New York 1895); Lavissè, ‘Histoire de France’ (Vol. VIII, Paris 1906); Ormesson, ‘De l'administration de Louis XIV’ (ib. 1850); Pardoe, J., ‘Louis XIV and the Court of France in the 17th Century’ (3 vols., London 1886); Philippson, ‘Das Zeitalter Ludwigs des Vierzehnten’ (Berlin 1879); Voltaire, ‘Siècle de Louis XIV’ (Eng. trans., ed. Masson and Prothero, 3 vols., Cambridge 1882–1912); and ‘Cambridge Modern History’ (Vol. V, Cambridge 1908). An annotated edition of his letters and other documents was published at Paris in six volumes in 1806.

LOUIS XV, king of France: b. Versailles, France, 15 Feb. 1710; d. there, 10 May 1774. He was the great-grandson and successor of Louis XIV, and coming to the throne when only five years old, Philip, Duke of Orleans, was made regent. Louis was declared of age in 1723 and married Marie Leczinska, daughter of the king of Poland. The Duke of Orleans died that year and was succeeded as Prime Minister by the Duke of Bourbon, who was removed in 1725 to make way for Cardinal Fleury, who died in 1743. After the cardinal's death the king's mistresses, Pompadour and Du Barry, controlled the election of the prime minister and other officers. In 1741 France became entangled in the war of the Austrian Succession against Austria, which was ended by the Treaty of Aix-la-Chapelle in 1748. In 1756 she was involved in the Seven Years' War, in which Austria was the ally of France. This was ended by the Peace of Paris in 1763. By this treaty Louisiana and Canada, as well as her Indian possessions, were lost to France. In 1764 the Jesuit order was suppressed. The kingdom was left impoverished at the death of Louis, partly by war and partly through the enormous sums squandered upon the royal mistresses. Consult Broglie, ‘Le secret duroi’ (Paris 1878); Carré, H., ‘La France sous Louis XV’ (Paris 1891); De Tocqueville, ‘Histoire philosophique du règne de Louis XV’ (Paris 1846); Fleury, ‘Louis XV intime et les petites maîtresses’ (Paris 1909); Goncourt, ‘Le maitresses de Louis XV’ (ib. 1860); Haggard, ‘The Real Louis XV’ (2 vols., London 1906); Pajot, ‘Les guerres sous Louis XV’ (Paris 1881–92); Cambridge, ‘Modern History’ (Vol. VI, Cambridge 1908).

LOUIS XVI, king of France: b. Versailles, 23 Aug. 1754; d. Paris, 21 Jan. 1793. He was the third son of Louis and of Marie Josepha, daughter of Frederic Augustus, king of Poland and Elector of Saxony. During the lifetime of Louis XV he bore the title of Duke of Berri. Amid the corruptions of the French court he kept aloof from licentiousness, was reserved and taciturn, and took most delight in practising some mechanical art, such as lock-making or printing. In 1770 he married Marie Antoinette, archduchess of Austria, and four years later became king by the death of his grandfather. He began his reign with many popular measures tending to alleviate the financial distress under which the country labored, and his appointment of Turgot (1775) as Minister of Finance, gave general satisfaction. The people were moreover pleased to see the parliaments again convened (1774), and the king set an example of national economy and retrenchment by the simplicity of his personal life, and the reduction of his retinue. The war of the American Revolution had sent Franklin and Deane to Paris to ask help for the young republic. Louis XVI was weak enough to take sides with the English colonists against their mother country, and the French and English war cost France an amount of treasure that almost plunged her into bankruptcy. At the same time French enthusiasm, roused in favor of republicanism, caused a feeling to prevail which threatened to endanger the stability of the monarchy. Necker, who had become Controller-General in 1776, by his attempts at reform and economy in order that the privileged orders should bear their share of taxation, so offended the nobility that he was compelled to resign (1781) and was succeeded by the reckless and wasteful Calonne. The queen was meanwhile very unpopular, and the affair of the «Diamond Necklace» in 1785 (q.v.) was made to aggravate public disaffection toward the throne. The notables met in 1787, but rejected a measure for universal taxation which would comprise the notables and clergy of the realm. Calonne, the finance minister, resigned, bankruptcy menaced the nation and Necker was recalled (1778), and suggested the convening of the States-General. The assembly met amid great popular excitement in May 1789, at Versailles; a series of reforms in public expenditure was begun, and the country was filled with enthusiasm. Necker sought to reproduce on French soil the limited monarchy of Great Britain. Louis proposed concessions, which were coldly greeted, and when he dissolved the assembly, Mirabeau, who sat in the Third Estate, defied the royal power, and refused, in the name of the people, to obey the mandate of dissolution. So great meanwhile was the excitement and anxiety which reigned in Paris that a national guard was formed with Lafayette for a commander. The king vacillated, dismissed Necker, surrounded Paris with his army and the people rose in a burst of frenzy and sacked the Bastile. The king ordered the approach of the troops on Paris, but to conciliate the people appeared at Hotel de

Ville wearing the tricolor. Meanwhile the princes of the blood and the nobles were leaving the country, Necker was recalled, and the king returned to Versailles, but on 5 October the mob took possession of the royal palace there, and compelled the king and the royal family to return with them to Paris, where they were kept strictly guarded in the Tuileries. There they were confined as prisoners till the following year (1790). Necker had fled to Switzerland; Mirabeau, the one hope of the monarchy, had died. The king made an attempt to visit Saint Cloud (1791) but was prevented by the mob. He then escaped unnoticed from the Tuileries, but was stopped at Varennes, 150 miles from Paris. The invasion of France by the Prussians and Austrians roused the Parisians to fury. They stormed the Tuileries and massacred the Swiss guard; the royal family were imprisoned in the ancient fortress known as the Temple. The national convention met on 20 September; in December they brought the king to trial on a charge of conspiring to overthrow the constitution and restore the ancient order of things. He was condemned to death by an absolute majority of one vote in a house that contained 749 members (5 Jan. 1793) and was guillotined. A feeble but well-meaning ruler, he suffered for the sins of his house. His elder son had died in 1789; his younger son (Louis XVII) became the Dauphin, and his daughter was known as the Duchess of Angoulême. Consult Beaucourt, ‘Captivité et derniers momento de Louis XVI’ (Paris 1892); Bouvet, ‘Histoire de Louis XVI’ (ib. 1825); Courian, ‘Louis XVI et la Révolution’ (ib. 1893); Haggard, A. C. P., ‘Louis XVI and Marie Antoinette’ (London 1909); Jobez, ‘La France sous Louis XVI’ (Paris 1877–93); Lavissè, ‘Histoire de France’ (Vol. IX, ib. 1910); Saint-Amand, ‘Marie Antoinette and the Downfall of Royalty’ (Eng. trans. by E. G. Martin, New York 1898).

LOUIS XVII, titular king of France: b. Versailles, 27 March 1785; d. Paris, 8 June 1795. He was the second son of Louis XVI and Marie Antoinette; was at first styled Duc de Normandie; and after the death of his elder brother, in 1789, became heir to the throne. With his relatives, in 1792, he was imprisoned in the Temple; after his father's death in the following year was styled king by the Royalists; but being given into the keeping of a shoemaker named Simon, in derision called his tutor, was subjected to brutal treatment, from which he died. The fact of his death was denied by certain impostors, whose claims to his name and to the throne found some supporters, was discredited by many, and there was no lack of claimants to the title, there being in all some 40 persons who claimed to be the legitimist king. The chief among these was the so-called Comte de Richemont, whose real name was François Hébert, a native of the Rouen district, and who first claimed in 1828; and the Potsdam watchmaker, Karl Wilhelm Naundorff (d. 1845), who certainly bore a striking resemblance to the Bourbon family, resided in France for three years, and was banished in 1836, and whose children raised actions in 1851 and 1874 to vindicate their claims. About the middle of the 19th century, Eleazar Williams (q.v.), a half-breed Indian missionary, born in the State of New York, was led to believe that he was the lost Dauphin, he and his friends declaring that he had been delivered from prison and while still very young brought to this country. He died in 1858. Although Williams made little attempt to enforce his own claim, others argued it, and a book was written in its support. But nothing in the nature of historical proof has been established to cast doubt on the actual death of the Dauphin as above related. Consult Bourgeois, A., ‘Etude historique sur Louis XVII’ (Paris 1905); Bülau, ‘Geheime Geschichten undratselhafte Menschen’ (Vol. II, 2d ed., Leipzig 1863); Chantelauze, ‘Louis XVII, son enfance, sa prison, et sa mort au Temple’ (Paris 1895); Evans, ‘The Story of Louis XVII’ of France’ (London 1893); Hanson, ‘The Lost Prince’ (New York 1854); and J. Sanford Saltus’ ‘Bibliography of Louis XVII’ (New York 1908).

LOUIS XVIII, «Stanislaus Xavier» (given the title of Le Desiré, by the Chamber of Deputies), king of France: b. Versailles, France, 17 Nov. 1755; d. Paris, 16 Sept. 1824. As the younger brother of Louis XVI he was designated Monsieur, his rank in the nobility being Count of Provence. He early showed himself a political marplot, a hinderer of reform and one of the great obstacles to his brother's success in handling the difficulties of the revolutionary movement. When the king escaped from the guards of the Tuileries (1791), Monsieur was by his side, and while Louis XVI was seized and taken back to confinement, escaped to the frontier. With his brother, the Count d'Artois, he held court for some time at Coblenz, where he issued animadversions on the revolutionists in France, and seriously complicated the difficulties of the royalist cause by his want of temper and judgment. When the Duke of Brunswick invaded France, Monsieur and the Count d'Artois joined his forces and shared his disasters. On the death of Louis XVI (1793) the Count of Provence declared his nephew king, and when Louis XVII died (1795) he took the title of king of France. He wandered from court to court of Europe, and finally settled in England (1807), where he remained until the fall of Napoleon. At last he crossed the Channel and entered Paris (3 May 1814) after an absence of 23 years.

His reign was inaugurated with the bitter retaliatory measures of the White Terror (q.v.). When Napoleon made his escape from Elba and arrived at Paris (1 March 1815) the unpopularity of the Bourbon restoration was proved by the enthusiasm and devotion of those who flocked to his standard. The king fled from Paris, but, after the battle of Waterloo, was once more restored, entered the capital under the protection of victorious Wellington, and appointed a new ministry with Talleyrand at the head of it. Louis proceeded to disband the army, to exclude from the general amnesty those who came under the head of «rebels,» those who had voted for the death of Louis XVI and were consequently «regicides,» and those who had received rank and honors from Napoleon in 1815. The rest of his reign was satisfactory neither to Blues nor Reds, and the real stay of the country was the Duc de Richelieu, the successor of Talleyrand. In accordance with the policy of the Holy Alliance the despotic Ferdinand VII was re-established on the Spanish throne by a French army (1823) and the last year of the king's life was spent in disease, followed by paralysis, which carried off a feeble and illiberal monarch whose only work in life had been to prove that political disquiet in France had not been and was not to be allayed by the restoration of the Bourbons. Consult Daudet, E., ‘La terreur blanche’ (Paris 1878); and ‘Histoire de la restauration, 1814–30’ (ib. 1882); Dulaure and Anguis, ‘Histoire de la révolution depvuis 1814 jusqu'à 1830’ (1834–38); Hall, J. R., ‘The Bourbon Restoration’ (Boston 1909); Romberg and Malet, ‘Louis XVIII et les cent-jours à Gand’ (Paris 1898); Saint-Amand, ‘The Duchess of Angoulême and the Two Restorations’ (trans. by J. Davis, New York 1902); Viel Castel, ‘Histoire de la Restauration’ (Paris 1860 et seq.).

LOUIS PHILIPPE, fē-lēp, king of the French: b. Paris, 6 Oct. 1773; d. Claremont, near Windsor, England, 26 Aug. 1850. He was the eldest son of Duke Louis Philippe Joseph of Orleans, afterward surnamed Egalité, and of the Princess Louise Marie Adelaide of Penthièvre. In infancy he held the title of Duke of Valois, and in 1785 that of Duke of Chartres. In 1782 his father entrusted the education of Louis Philippe and his other children to Madame de Genlis. Having entered the national guard in 1790, he became a member of the Jacobin Club. In May 1792 he commanded a brigade of cavalry in Luckner's army, rose under Kellerman in September to be lieutenant-general and did good service in the famous cannonade at Valmy. He next joined the army of Dumouriez, and took part in the victory of Jamappes. Dumouriez had formed a scheme for placing him on the throne as a constitutional monarch, and being included in the order of arrest directed against Dumouriez, in April 1793 he took refuge within Austrian territory. After many wanderings he procured the situation of teacher of geography and mathematics in the school of Reichenau, near Coire, where, during eight months, he passed under the name of Chabaud-Latour. In 1796 Louis Philippe, since his father's death Duke of Orleans, arrived in America, where, in the following year, he was joined by his two younger brothers. The three princes traveled in the United States, and at last took ship for England, where they landed in 1800. The brothers lived about seven years at Twickenham, near London. After the news of Napoleon's downfall the Duke of Orleans set out for Paris, where he was received by Louis XVIII, not without distrust and in 1814 appointed colonel of hussars. On the news of Napoleon's return he set out for Lyons to assist the operations of the Count d'Artois. After an unsuccessful attempt to hold the northern departments for the Bourbons, he left Lille and set out for England to join his family, who had preceded him. He returned in July 1815 and obtained the removal of the sequestration of his domains, which had been imposed by the imperial government. The estrangement of Louis XVII from him was, however, increased, and he withdrew in October 1815 to England, but returned to Paris in the following year. After the coronation of Charles X his relations with the court became more friendly. During the bloody days of 27, 28 and 29 July, the court had entirely forgotten him. Nor during the struggle was his name mentioned in Paris. On the 29th the provisional chamber, on Laffitte's suggestion, resolved to offer him the regency as lieutenant-general of the kingdom. In a sitting of the chamber on 9 August he swore to the reform charter, and ascended the throne as king of the French. Being hated by the extreme Democrats, frequent attempts were made on his life; but during this period France made vast progress in industry and wealth, and the durability of the July throne seemed to be thereby consolidated. But his selfish policy had estranged the European courts, and a loud demand for a change in the electoral system being foolishly opposed by the king and the Guizot Ministry, his position in France became extremely precarious. On 22 Feb. 1848 an insurrection began in the streets of Paris. Next day Guizot gave in his resignation; but the insurrection gained in extent and intensity, and neither the command given to the troops on the morning of the 24th to stop firing, nor the abdication of the king a few hours after in favor of his grandson, the Count of Paris, sufficed to allay the storm. Louis Philippe, completely disheartened, unsupported by any administration, and forsaken even by the courtiers, about midnight of 24 February quitted the Tuileries with his family, and fled from Paris, and on 3 March 1848 took up his residence in England, which he never again left. Consult ‘Mon Journal événements de 1815’; (Paris 1849); Arnaud, R., ‘Louis Philippe and his Sister’ (London 1908); Blanc, Louis, ‘Histoire de dix ans 1830–40’ (Paris 1841–44); Lemoine, ‘Abdication du roi Louis Philippe’ (ib. 1851); Dumas, A. (1852); Nouvion (1861); Villault de Gerainville (1870–76); Sternberg, ‘The Secret of Louis Philippe’ (New York 1914); Weill, G., ‘La France sous la monarchié du Juillet’ (Paris 1902); and ‘Cambridge Modern History’ (Vol. X, Cambridge 1907).

LOUIS D'OR, loo'ē dôr (Fr. «golden Louis»), a gold coin formerly current in France. It was first struck in consequence of an edict of Louis XIII, dated 31 March 1640. It was 22 carats fine, and originally was worth 10 livres of the period (equal to 21 francs 33 centimes). Afterward it ranged in value from about $4 to $4.60. In 1810 the louis d'or was replaced by the napoleon of 20 francs. In some parts of Germany the five-thaler gold piece was popularly known as the louis d'or.

LOUISA, loo-ē'za, queen of Prussia. See Luise, Auguste Wilhemine Amalie, Queen of Prussia.

LOUISBURG, loo'is-berg or loo'ē-berg, town of Cape Breton Island in the province of Nova Scotia; on the coast at the entrance to the Gulf of Saint Lawrence. The earliest mention of English Harbor, later called Louisburg, is found on Champlain's map of 1612 and was, in his time, the resort of fishermen mainly from England. It was not until 1713 that Louisburg came into prominence by the removal to it of the French officers and inhabitants from Acadia and Newfoundland, then ceded to England under the Treaty of Utrecht. The city is chiefly noted for the historical events which transpired in and around it and for the ruins of the fortifications. These fortifications were commenced in 1720 and completed about the year 1744 at a cost to the French government of 30,000,000 livres, equal to-day to about $10,000,000. They enclosed an area of about 100 acres and had a circumference of 2½ miles. On the declaration of war in March 1744 between France and England, Louisburg was the object of an attack by the expedition sent out by the New England colonies. This was composed of 3,250 men from Massachusetts, 516 from Connecticut, 304 from New Hampshire and 150 from Rhode Island, supplemented by 14 vessels, carrying 200 guns, fitted out by the provinces, and by Commodore Warren's West India fleet of 10 vessels carrying 460 guns, beside the captured *Vigilante* of 64 guns. The siege, begun on 30 April 1745, ended in the capitulation by Governor Duchambon on 16 June. By the Treaty of Aix-la-Chapelle in 1748, the island of Cape Breton was restored to France and the fortifications at Louisburg were considerably strengthened and a new battery erected at Point Rochefort at a cost of $5,000,000. In 1758, two years after war had been declared between France and England, a second expedition, consisting of 23 ships of the line, 18 frigates and 120 transports with 12,000 troops, assembled at Halifax, arrived at Louisburg on 28 June, laid siege to the fortress; and on 26 July it was surrendered to the British under the command of General Amherst, who had as one of his brigadiers James Wolfe. Thus what has been called the "Keystone of the arch of French power in America" had been shattered, and the way was cleared for the culminating attack on the fortress of Quebec. Shortly after the capture the great fortress was razed to the ground, and to-day only the casements or bomb-proofs remain. The ruins are now being preserved, and a memorial tower has been erected bearing the names of the killed and wounded in both sieges.

The first school in Nova Scotia is said to have been established at Louisburg by the Ladies of the Congregation in 1737.

Louisburg is now becoming a port of considerable importance, having been established as the eastern terminal port of the Intercolonial Railway and used by the Dominion Steel Corporation as a shipping port for a large portion of their products. See COLONIAL WARS IN AMERICA.

LOUISE, loo-ēz, an opera of Parisian life by Gustave Charpentier. First performed in Paris 1900; in New York 1908. Louise, a charming young dressmaker, attracts the attention and love of a romantic young artist, Julien, who finally persuades her to give up her life of drudgery and live with him in a little home amid the gay and careless Bohemian circle of Montmartre. During a lively revel Louise's mother appears and begs the girl to return home, as her father is ill. With an effort Louise tears herself away and resumes her former drab life. The reproaches of her father serve only to accentuate the memory of Julien's loving kindness — and she goes back to the man who had given her happiness.

LOUISEVILLE, loo'ēz-vĭl, or **RIVIERE DU LOUP** (enhaut), rē-vē-ā dü loo, Canada, town, capital of Maskinongé County, in the province of Quebec, on Lake Saint Peter, an expansion of the Saint Lawrence River, and on the Canadian Pacific Railroad, about 18 miles west of Three Rivers. The mineral springs of Saint Léon in the vicinity, bring many people to Louiseville. The chief industries are a foundry, planing mill, box making and shirt factory. Pop. 1,675.

LOUISIADE (loo-ē-zē-ăd) **ARCHIPELAGO**, in the Coral Sea, southeast of New Guinea; belongs, administratively, to British New Guinea. The largest islands of the group are Southeast (Sudest) Island, Saint Aignan and Rossel. Southeast Island is about 45 miles long and from 4 to 10 miles wide. Rossel and Saint Aignan each have an area of over 100 square miles. They are all mountainous. Saint Aignan has a peak about 3,500 feet in height. Many of the small islands are of coral formation; and the vegetation is varied and luxuriant. The islands were discovered in 1666 by Torres, and became British possessions in 1888. The majority of the inhabitants are uncivilized, and are of the Papuan race.

LOUISIANA, one of the United States, bordering on the Gulf of Mexico, is the largest and most important of the Southern States. The name "Louisiana" was first applied by La Salle in 1683 to the vast territory watered by the Mississippi and its tributaries, which he thus dedicated to King Louis XIV. It was admitted as a Territory 20 Dec. 1803 after the completion of the purchase and was the fifth State admitted to the Union under the Federal Constitution in 1812. It lies between lat. 28° 59′ and 33° N. and long. 88° 40′ and 94° W. Its extreme length is 281 miles, and extreme width 275 miles, with an area of 48,506 square miles. It is bounded on the north by Arkansas on parallel of 33° to the Mississippi and thence on the parallel of 31° eastward to Pearl River; on the south by the Gulf of Mexico, on the west by the Sabine River and a line drawn from it directly north to meet the 33° parallel. Within these limits are included 45,409 square miles of land and 3,047 of water, 637 in rivers and 3,370 in lakes. The State is divided into 64 parishes gradually created from the five original divisions under French and Spanish domination.

Rivers and Lakes.— The Mississippi River in its devious course splits Louisiana in twain with 37,000 square miles on the western bank. With but rare interruptions the river flows through alluvial soils of low elevation requiring the protection of levees. The coast line of the delta and eastward consists of lands little above sea-level intersected by small tracts of elevated prairies and low ridges covered with live oak. Northwestward the land rises until in North Louisiana the hills attain the height of 500 feet. Both on the Mississippi and the other river valleys, the highest land is formed by the banks themselves, from which the land slopes away gradually to the marshes. To protect these low-lying lands there have been built at vast expense some 1,500 miles of levees of great strength. These, however, give way occasionally before the mass of waters brought down by the Mississippi in flood, and great damage results. (See LEVEE). The drainage system of the State is toward the Gulf and mainly through the Mississippi and its tributaries, the Red River and the Ouachita. On the east Pearl River and on the west the Calcasieu River and the Sabine, which divides Louisiana from Texas — each drain small districts. The Red River formerly flowed directly to the Gulf of Mexico. Its old channel is now filled by the Atchafalaya, which has increased so rapidly of late years as to give rise to fears of its becoming the main channel of the Mississippi. The lakes of Louisiana are of two kinds. Those on the coast are shallow estuaries enclosed within the delta, of which the greatest are lakes Pontchartrain and Maurepas. At the entrance to the former is Lake Borgne. A second class is formed by the curved sections of the river which are cut off and silted up as in the smaller rivers by the action of accumulated débris and rafts of driftwood such as are found above Shreveport. These are rapidly disappearing through the removal of the obstructions, and the lands are being reclaimed.

Of the 28,000,000 acres of land in the State only 6,861,247 are in cultivation. Nearly the entire upland is covered by strata of drift or red sandy clays. One thousand nine hundred square miles are alluvial. The soil next the river is the lightest; the surface of the backlands consists of a peculiarly friable soil known as buckshot to such a depth as to permit of the deepest cultivation and with a high absorptive power which secures crops against drought. South of the Red River the soils are less varied in character, but all are rich in the essential elements of plant food and require only drainage and good culture to produce excellent crops. The land is destributed as follows: Alluvial lands, 13,225 square miles; bluff prairies, 5,739 square miles; oak uplands, 8,103 square miles; long-leaf pine hills, 7,582 square miles; long-leaf pine flats, 2,556 square miles; central prairies, 785 square miles; coast marshes, 7,420 square miles.

Geology and Mineralogy.—The entire State is part of the Mississippi deposit on the bottom of an ancient gulf whose shore touched Cairo, Ill. Its oldest sediments were Cretaceous, now covered except in a few small spots in the northwest. The upland region west of the northern course of the Calcasieu, and of the Ouachita, is a mass of horizontal Tertiary beds, clays and clay sandstones. The entire alluvial region and coast swamps, besides much bordering prairie, is Quarternary. Such formations could hardly be rich in minerals, and though some iron ore and low-grade brown coal are found in the Tertiary districts, the only important minerals are rock salt, sulphur and petroleum. The salt is found in the chain of isolated hills known as islands, commencing with Petite Anse on the Gulf and extending to New Iberia. The first workings were at Avery's Island; two other mines have been opened and the output has been increased to 200,000 tons annually. The development of the oil and gas industries has been very large. From the nine fields were produced in 1917 11,682,539 barrels. Several other localities show indications of great promise. The production of natural gas from seven fields was over 32,000,000,000 cubic feet. The amount of sulphur produced from the mines at Calcasieu was, in 1915, 379,885 tons.

Climate and Rainfall.— Louisiana, ranging from the parallel of lat. 33° to 29° N. is semi-tropical in climate and products. The summer heat reaches 105 and averages 85 for the hottest month; it does not reach zero south of Shreveport, and the coldest month ranges on an average from 45° to 60°, according to location. The gulf vapors make it very equable, the prevailing winds being south and southwest — that is, from the ocean. There are only three months of frost in the year, the beginning varying from the 1st of November to the 1st of December. The rainfall varies from an average of 60 inches a year in the southeastern part, to 50 in the northern. This abundant moisture and the steady warmth cover the State with luxuriant tropical growths, and the magnificent profusion and beauty of its flowers are famous. The magnolia is most familiar as a specially Southern product, but the roses, jasmines, oleanders, camellias, etc., are notably beautiful. The orange, fig and most other semi-tropical fruits will flourish here.

Fauna.— The only large quadrupeds surviving are black bears and a few catamounts in the less accessible forests and swamps. Many deer are found during the winter. The wildcat is not uncommon, and the raccoon and opossum are familiar. The alligator is common to all bayous and ponds. Bird-life is plentiful; it comprises eagles and vultures, pelicans and cranes, besides wild turkeys, geese and ducks. Under the working of the Conservation Commission created in 1916 the fauna of the State are fully protected and exact statistics are compiled showing the value produced. Deer have largely increased in number. In 1917, 185,614 ducks were marketed, a decrease from the number of preceding years. The yield of fur-bearing animals, of which 5,002,840 were killed in 1912, fell to 1,813,190 in 1917. The alligator catch is diminishing rapidly. Through the action of the Sage Fund the area of bird preserves is now the largest in the United States and many rare species have been saved from utter extinction which threatened them.

Forestry.— A large proportion of the entire forest wealth of the State is represented by immense areas of long and short leaf pine. It is estimated that the standing timber in 1918 was 91,000,000,000 feet of pine, cypress and hardwood. The present rate of cutting over 60,000,000 annually cannot be maintained for more than 10 years. Fortunately the cut-over lands are valuable for farming purposes. The forestry division of the Conservation Commission has done much for the protection of the forests from destructive fires and has taken steps toward reforestation. In lumber production Louisiana ranks second in the United States.

Agriculture.—From the considerations mentioned, an exceptionally fertile soil, a warm climate with variations from northern highlands to southern coast plains, Louisiana has remarkable natural advantages for a great variety of products, from temperate to semitropic. Yet less than two-fifths of the soil has been even nominally in farms, and only one-fourth improved; and of the total in 1916, $154,735,819 in value of farm crops, $123,567,811, or over eleven-twelfths, was in two money crops and two food crops, cotton and sugar-cane, corn and rice. This lack of diversification of crops is largely a result of the old

LOUISIANA.

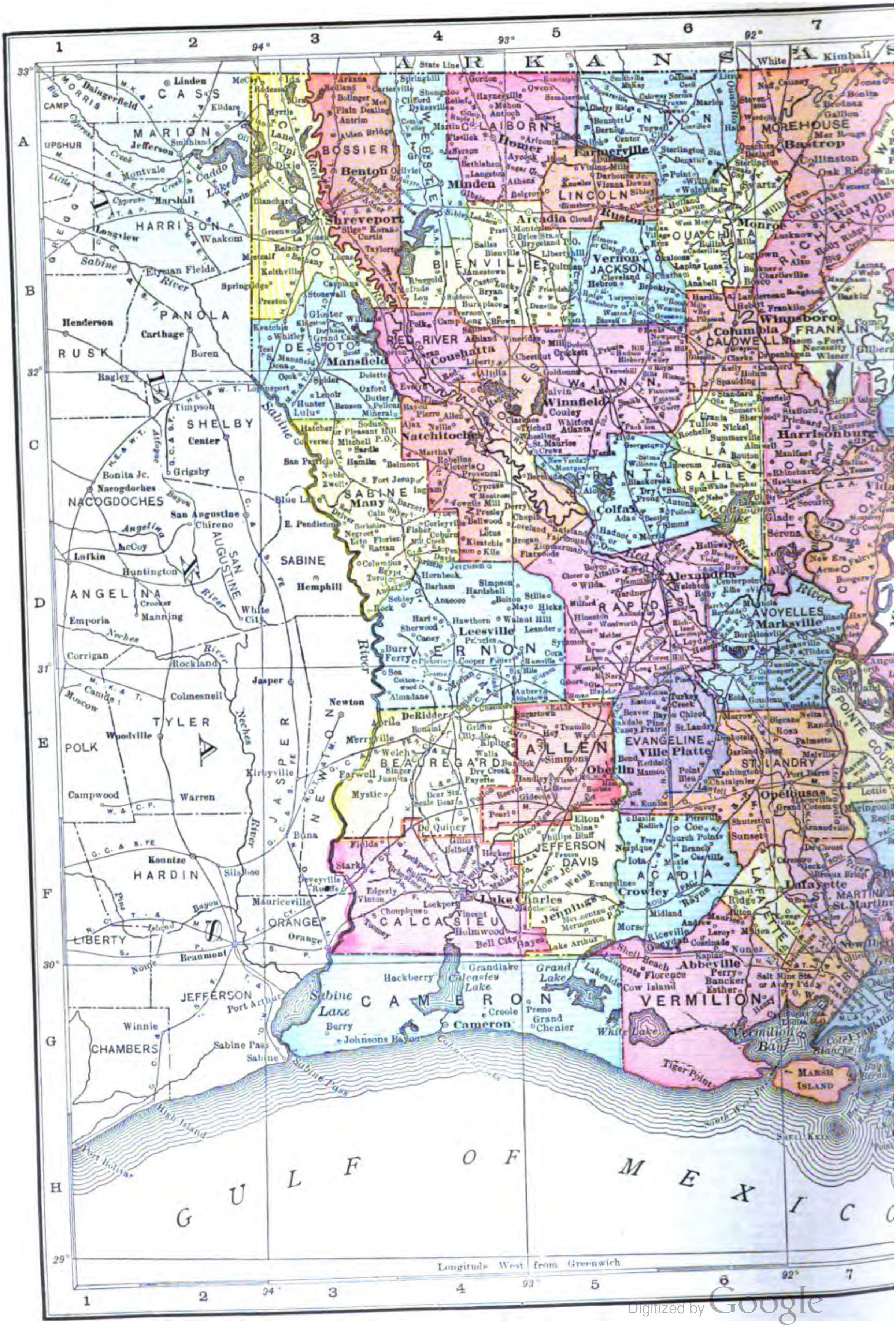
Estimated population, 1,829,130

COUNTIES

Pop.		
31,847	Acadia	F 6
......	Allen (Pop. incl. in Calcasieu Co.)	E 5
23,887	Ascension	F 9
24,128	Assumption	G 8
34,102	Avoyelles	D 7
......	Beauregard (Pop. incl. in Calcasieu Co.)	E 4
21,776	Bienville	B 4
21,738	Bossier	A 3
58,200	Caddo	A 3
62,767	Calcasieu	F 4
8,593	Caldwell	B 6
4,288	Cameron	G 4
10,415	Catahoula	D 7
25,050	Claiborne	A 5
14,278	Concordia	D 7
27,689	De Soto	B 3
34,580	East Baton Rouge	E 8
11,637	East Carroll	A 8
20,055	East Feliciana	E 9
......	Evangeline (Pop. incl. in St. Landry Co.)	E 6
11,989	Franklin	B 7
15,958	Grant	C 5
31,262	Iberia	G 7
30,954	Iberville	F 8
13,818	Jackson	B 5
18,247	Jefferson	G 10
......	Jefferson Davis (Pop. incl. in Calcasieu Co.)	F 25
28,733	Lafayette	F 6
33,111	Lafourche	G 10
9,402	La Salle	C 6
18,485	Lincoln	A 5
10,627	Livingston	F 9
10,676	Madison	B 8
18,786	Morehouse	A 7
36,455	Natchitoches	C 4
339,075	Orleans	F 11
25,830	Ouachita	B 6
12,524	Plaquemines	G 11
25,289	Pointe Coupee	E 7
44,545	Rapides	D 6
11,402	Red River	B 4
15,769	Richland	B 7
19,874	Sabine	D 4
5,277	St. Bernard	G 12
11,207	St. Charles	G 10
9,172	St. Helena	E 9
23,009	St. James	F 9
14,338	St. John the Baptist	F 10
66,661	St. Landry	E 7
23,070	St. Martin	F 7
39,368	St. Mary	G 8
18,917	St. Tammany	F 11
29,160	Tangipahoa	E 10
17,060	Tensas	C 8
28,320	Terrebonne	H 9
20,451	Union	A 6
26,390	Vermilion	G 6
17,384	Vernon	D 4
18,886	Washington	E 10
19,186	Webster	A 4
12,636	West Baton Rouge	E 8
6,249	West Carroll	A 8
13,449	West Feliciana	E 8
18,357	Winn	C 5

Incorporated Cities, Towns, and Villages

Pop.		
2,907	Abbeville	G 6
365	Abita Springs	F 10
15,333	Alexandria	D 6
1,677	Amite	E 10
346	Angie	E 11
1,079	Arcadia	A 5
279	Arnaudville	F 7
514	Athens	B 5
311	Atlanta	C 5
854	Bastrop	A 7
17,176	Baton Rouge	F 9
630	Bayou Sara	E 7
318	Benton	A 3
781	Bernice	A 5
2,183	Berwick	G 8
606	Bienville	B 4
273	Bonita	A 7
775	Bossier City, Bossier	A 3
865	Boyce	G 7
1,339	Breaux Bridge	F 7
499	Broussard	F 7
390	Brusly Landing, West Baton Rouge	E 8
1,765	Bunkie	E 6
664	Campti	C 4
609	Carencro	F 7
181	Chatham	B 6
498	Cheneyville	E 6
481	Church Point	F 6
918	Clinton	E 9
1,049	Colfax	D 5
500	Columbia	B 6
333	Collinston	A 7
866	Cottonport	E 7
564	Coushatta	B 4
2,601	Covington	F 10
5,099	Crowley	F 6
308	Delcambre	G 7
685	Delhi	B 8
574	Denham Springs	F 9
715	De Quincy	F 4
2,100	De Ridder	E 4
845	Dodson	B 5
4,090	Donaldsonville	F 8
714	Dubach	A 5
120	Duson, Lafayette	F 6
238	Echo, Rapides	D 6
575	Erath	G 7
898	Eros	B 6
544	Esterwood, Acadia	F 6
1,684	Eunice	E 6
299	Evergreen	E 7
598	Farmerville	A 5
577	Ferriday	C 7
3,857	Franklin	G 7
814	Franklinton	E 11
1,238	Fullerton	D 4
1,065	Gibsland	B 4
485	Grand Cane	B 3
392	Grand Coteau	F 7
268	Greensburg	E 9
1,081	Gueydan	F 6
2,942	Hammond	F 9
361	Harrisonburg	C 7
249	Haughton	A 3
663	Haynesville	A 4
1,855	Homer	A 5
459	Hornbeck	D 4
5,024	Houma	G 9
1,004	Independence	E 10
769	Iota	F 5
2,146	Jackson	E 8
2,206	Jeanerette	G 7
689	Jena, La Salle	C 6
3,925	Jennings	F 5
1,134	Jonesboro	B 5
287	Jonesville	C 7
396	Junction City, Claiborne	A 5
315	Kaplan	G 6
3,609	Kentwood	E 9
635	Kinder	F 5
6,392	Lafayette	F 7
1,093	Lake Arthur	F 5
14,447	Lake Charles	F 5
1,568	Lake Providence	A 8
1,058	Lecompte	D 6
2,043	Leesville	D 4
669	Lockport	G 10
420	Logansport	C 3
1,028	Madisonville	F 10
1,166	Mandeville	F 11
470	Mangham	B 7
1,799	Mansfield	C 3
695	Mansura	E 6
683	Many	C 4
447	Maringouin	E 7
226	Marion	A 6
1,076	Marksville	D 7
285	Marthaville	C 4
1,093	Melville	E 7
323	Mermenton	F 5
536	Mer Rouge	A 7
3,002	Minden	A 4
13,214	Monroe	B 7
174	Montgomery	C 5
728	Moreauville	D 7
5,477	Morgan City	G 8
296	Morganza, Pointe Coupee	E 7
237	Morse	F 5
1,201	Napoleonville	G 8
2,532	Natchitoches	C 4
424	Newelton	B 8
7 499	New Iberia	G 7
271,747	New Orleans	G 11
1,352	New Roads	E 8
453	Noble	C 3
398	Oak Grove	A 8
332	Oak Ridge	A 7
232	Oberlin	E 5
260	Olla	C 6
4,623	Opelousas	F 7
2,998	Patterson	G 8
277	Pearl River	F 11
1,212	Pineville	D 6
474	Plain Dealing	A 3
4,955	Plaquemine	F 8
380	Plaucheville	E 7
442	Pleasant Hill	C 3
675	Pollock	D 6
1,055	Ponchatoula	F 9
262	Provencal	C 4
215	Quitman	B 5
425	Ramsay, St. Tammany	F 11
2,247	Rayne	F 6
1,079	Rayville	B 7
319	Richardsontown, Washington	E 10
265	Rio	E 11
438	Robeline	C 4
586	Roseland	E 10
325	Rosepine, Vernon	D 4
3,377	Ruston	B 5
346	Saline	B 4
239	Scott	F 6
35,230	Shreveport	B 3
282	Simsboro	B 5
287	Slaughter	E 8
2,188	Slidell	F 11
966	St. Francisville	E 8
740	St. Joseph	C 8
2,318	St. Martinville	F 7
377	Sunset	F 6
847	Tallulah	B 8
394	Tangipahoa	E 9
3,824	Thibodaux	G 9
633	Tioga	D 6
182	Verda (New Verda P. O.)	C 5
1,345	Vidalia	D 8
603	Ville Platte	E 6
826	Vivian	A 2
592	Walker, Livingston	F 9
1,528	Washington	E 6
445	Water Proof	C 8
1,250	Welsh	F 5
1,127	West Monroe	B 6
2,289	White Castle	F 8
762	Wilson	E 8
2,925	Winnfield	C 5
821	Winnsboro	B 7
328	Youngsville	F 7
419	Zachary	E 8
973	Zwolle	C 3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RICHLAND
DE SOTO
RED RIVER
WINN
CALDWELL
FRANKLIN
SABINE
NATCHITOCHES
GRANT
LA SALLE
CATAHOULA
CONCORDIA
RAPIDES
AVOYELLES
VERNON
BEAUREGARD
ALLEN
EVANGELINE
ST. LANDRY
POINTE COUPEE
CALCASIEU
JEFFERSON DAVIS
ACADIA
LAFAYETTE
ST. MARTIN
VERMILION
CAMERON
Shreveport
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Coushatta
Winnfield
Columbia
Winnsboro
Harrisonburg
Natchitoches
Many
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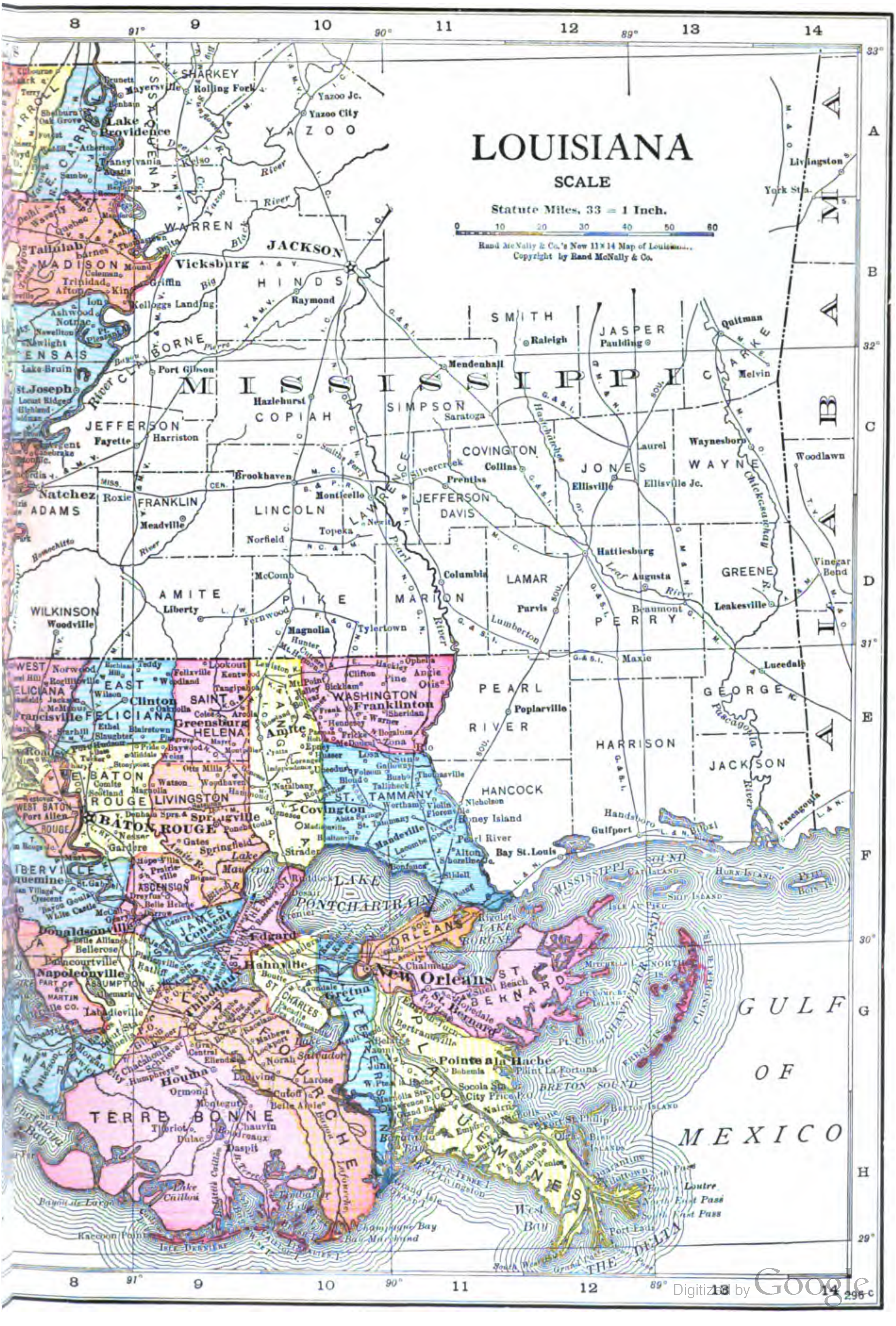
Alexandria
Marksville
Leesville
DeRidder
Oberlin
Ville Platte
Opelousas
Lake Charles
Jennings
Crowley
Lafayette
Abbeville
Cameron
Marshall
Jefferson
Longview
Henderson
Carthage
Center
Nacogdoches
San Augustine
Hemphill
Jasper
Newton
Woodville
Lufkin
Beaumont
Orange
Port Arthur
Sabine Pass
Sabine Lake
Calcasieu Lake
Grand Lake
White Lake
Vermilion Bay
Marsh Island
Cote Blanche Bay
Caddo Lake
Sabine River
Red River
Neches River
Angelina River
Sabine Pass
High Island
Port Bolivar
Tiger Point
South West Pass
GULF OF MEXICO
Longitude West from Greenwich


LOUISIANA
SCALE
Statute Miles, 33 = 1 Inch.
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Rand McNally & Co.'s New 11 x 14 Map of Louisiana.
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Rolling Fork
Mayersville
ISSAQUENA
YAZOO
Yazoo City
Yazoo Jc.
WARREN
Vicksburg
JACKSON
HINDS
Raymond
CLAIBORNE
Port Gibson
JEFFERSON
Fayette
Harriston
COPIAH
Hazlehurst
SIMPSON
Saratoga
Mendenhall
SMITH
Raleigh
JASPER
Paulding
CLARKE
Quitman
Melvin
Livingston
York Sta.
ADAMS
Natchez
Roxie
FRANKLIN
Meadville
LINCOLN
Brookhaven
Monticello
LAWRENCE
Silvercreek
COVINGTON
Collins
Prentiss
JEFFERSON DAVIS
JONES
Laurel
Ellisville
Ellisville Jc.
WAYNE
Waynesboro
Woodlawn
WILKINSON
Woodville
AMITE
Liberty
PIKE
McComb
Magnolia
Tylertown
Norfield
Topeka
MARION
Columbia
LAMAR
Purvis
Lumberton
FORREST
Hattiesburg
Augusta
PERRY
Beaumont
GREENE
Leakesville
Vinegar Bend
GEORGE
Lucedale
Maxie
PEARL RIVER
Poplarville
HARRISON
Handsboro
Gulfport
Biloxi
JACKSON
Pascagoula
HANCOCK
Nicholson
Honey Island
Pearl River
Bay St. Louis
Mississippi Sound
Cat Island
Ship Island
Horn Island
Petit Bois I.
Isle au Pied
Chandeleur Sound
Chandeleur Is.
Breton Sound
Breton Island
EAST CARROLL
WEST CARROLL
Lake Providence
MADISON
Tallulah
TENSAS
St. Joseph
Newlight
Lake Bruin
CONCORDIA
Vidalia
WEST FELICIANA
St. Francisville
EAST FELICIANA
Clinton
Jackson
SAINT HELENA
Greensburg
TANGIPAHOA
Amite
Kentwood
Hammond
WASHINGTON
Franklinton
Bogalusa
ST. TAMMANY
Covington
Mandeville
Slidell
EAST BATON ROUGE
Baton Rouge
WEST BATON ROUGE
Port Allen
LIVINGSTON
Springville
Denham Sprs.
IBERVILLE
Plaquemine
ASCENSION
Donaldsonville
ST. JAMES
Convent
ST. JOHN THE BAPTIST
Edgard
ASSUMPTION
Napoleonville
ST. CHARLES
Hahnville
JEFFERSON
Gretna
ORLEANS
New Orleans
ST. BERNARD
PLAQUEMINES
Pointe a la Hache
LAFOURCHE
Thibodaux
TERREBONNE
Houma
Lake Pontchartrain
Lake Borgne
Lake Maurepas
Barataria Bay
Timbalier Bay
Caillou Bay
Lake Caillou
Isle Dernière
Raccoon Point
West Bay
Bay Marchand
Grand Isle
Port Eads
Port St. Philip
Quarantine
Pass a Loutre
North East Pass
South East Pass
South Pass
South West Pass
THE DELTA
Pearl River
Leaf River
Pascagoula River
Chickasawhay R.
Yazoo River
Big Black River
Homochitto River

slave system, which tended to concentrate attention upon a few staples roughly cultivable by gangs. There are some indications of a change; but the chief feature has been the enormous development of irrigated rice culture, as told below. There has also been a progressive subdivision of farms; the average plantation of 1860 was over 500 acres, the average farm of 1910 was under 90. This does not, however, imply the cessation of large farms; on the contrary, Louisiana is the State of great plantations, there being over 11,000 containing more than 1,000 acres each. This is due to the heavy capital needed to carry on the sugar business, which must have a large territory to make fair returns. One result of the growth of the class of colored farmers, besides the cutting up of farms — their average being 40 acres to 150 for the white farmer — is the increase of rentals, they being usually too poor and unthrifty to buy. They slightly outnumber the white farmers, but they own only about one-seventh of their farms against nearly two-thirds owned by the whites, and there are nearly three times as many cash tenants and two and a half times as many share tenants as white. They operate but about one-fifth of the farm area, however. In cotton culture, Louisiana has been slower to recover from the Civil War than any other State, having not yet reached the figures of 1860, while several others have immeasurably surpassed them, and it has not greatly grown since 1890; its product in 1916 was 442,770 bales of a value of $33,207,750. Cane sugar, the great specialty of the State, produced in 1916 305,352 tons, worth $36,642,240. Louisiana produces three-fourths of all the cane grown in the United States, outside of Hawaii, and more than 11 times as much as the next heaviest producer, Georgia. This is an extensive crop, concentrating a great value on a small area; while the value of the crop was over half that of cotton, its acreage was only one-fifth as much; with nearly one-fourth the total value of farm products, it occupied only 8 per cent of the farm acreage. One of the great drawbacks to Louisiana sugar-cane raising is that about one-fifth has to be kept for seed and cannot be replaced in the same season, while in Cuba the tops of unfit canes are simply dropped into hoe-made holes, and there are plenty always to be had; the Louisiana seed cane often rots, the Cuban never. The Cuban cane is also much richer in sugar, and the yield per acre is about double. From all these causes, the cost of making a pound of sugar is about double in Louisiana what it is in Cuba. Corn, as in all the Southern States — owing to its value as a food crop, for feeding swine, and in some States for distilling — has always had far greater attention than any other cereal. In 1916 the crop was 44,009,772 bushels valued at $35,207,817. But the great coming food crop is rice, whose culture increased about two and a half times in the last decade, and nearly all of this in the last three years; owing to the introduction of improved methods by a number of Iowa immigrants, and of a new system of irrigation, which has revolutionized rice culture and worked a complete transformation in the great coast-prairie belt of southwestern Louisiana and southeastern Texas, formerly almost in primitive solitude. Up to 1897 nearly all the rice grown on these prairies was "Providence" rice, dependent mainly on rainfall. Then two years of drought showed that there was no security without irrigation, and there was a stampede to the "pump lands," where a new world was created by raising water from bayous. This district, as above said, is full of slightly raised ridges; the canals are run along these, not by digging, but by throwing up parallel dikes for a channel; as the water in all these regions lies below the land to be irrigated, it is raised by pumping plants at the heads of the canals and distributed to the lands by gravity; sometimes two or more pump stations are needed on the same canal to lift the water high enough. This immense draft on the water supply has created alarm for the future; but the whole region is underlaid with exhaustless water-bearing gravel strata, and easily bored wells can irrigate 100 acres without diminishing the flow. This prairie has the further advantage over the delta district, formerly the chief seat of the culture, that in the latter the heavy machinery needed for improved cultivation was apt to sink in the soil. In 1916 the rice grown was 4,627,581 sacks of a market value of $18,570,004.

The values of other crops for 1916 were:

Molasses	$4,826,630
Syrup	4,315,900
Hay	4,813,980
Oranges	127,460
Tobacco	175,000
Vegetables	2,310,000
Strawberries	1,750,000

Stock Raising.— The importance of the State for stock raising is receiving recognition and large increases are shown in statistics for 1918:

Horses	207,000
Milch cows	324,000
Other cattle	578,000
Sheep	209,000
Swine	1,568,000

The parish fairs have been highly successful.

Fisheries.— Louisiana ranks next to Florida among the Gulf States in the value of its fish-catch. As a whole, however, the industry seems not to be increasing largely; the statistics for 1917 show fresh fish, $1,141,259.33; salt water, $750,000. The oyster fishery is second only to that of Chesapeake Bay. It produced in 1917 2,310,972 bushels employing 680 boats. The oyster reefs extend almost unbroken from the mouth of Atchafalaya Bayou to the State line. Large canneries have been established on the Gulf. The seine fishery is declining; but Louisiana is still the chief source of shrimps. The catch of shrimps in 1918 was 23,160,581 pounds, value $850,000. The alligator industry is decreasing with the gradual exhaustion of the supply; at the same time the scarcity of hides constantly enhances the market value.

Manufactures.— These are chiefly represented by the working up of the large natural resources and are principally carried on in New Orleans, by far the largest of the six cities of the State. In 1914 the manufactured products were valued at $255,312,648, and those of New Orleans $69,814,081. The industrial tendency is to increase production, but to reduce labor. With the exception of sugar the chief industries of the State show a steady increase in value accompanied by a regular decrease in the numbers of wage-earners, a proof of a growth of labor efficiency. The number of laborers in 1910 was 84,243. In 1914 it was 77,665. The largest industry in the State was concerned with the utilizing of the immense timber resources. In 1914 516 establishments turned out products valued at $66,656,268. The sugar and molasses produced in 1914 were in value $57,948,322. The manufacture of cotton-seed oil and cake holds third place in 1914; the products were 5,910,907 gallons from 37 mills. This industry is fostered by the immense facilities for export and import afforded by the Mississippi River. The cleaning and polishing of rice gave a product of 391,728,722 lbs. from 24 mills. A wonderful increase occurred in the manufacture of food preparations, which starting in 1900, in the year 1914 attained the value of $11,714,543. War conditions largely influenced manufacturing in 1918. One of the principal effects has been the erection of important shipbuilding industries in and about New Orleans and the digging of a wide and deep canal connecting the Mississippi with Lake Pontchartrain.

Commerce and Transportation.—Louisiana is the richest State in the Union in total length of navigable streams, 3,771 miles. Its lower part is a vast web of paths to the ocean, aggregating 2,500 miles. The entire 600 miles of the Mississippi's length in the State is navigable and largely navigated; the jetties have trebled its value and made New Orleans a far greater corn and cotton port than before. A canal from the river to Lake Borgne has greatly lessened the distance from the city to the Gulf and to the coal fields of Alabama, hence reducing the cost of fuel for manufacturing purposes. The railroad facilities have not been very extensive till the last decade, when they increased from 1,739 to 2,801 miles and are now 3,221. The growing importance of New Orleans has led a number of trunk lines to make a special effort for its business; owing to the nature of the Gulf coast all turn away many miles from it. The chief lines are the Southern Pacific, the Texas Pacific, the Louisville and Nashville, the Queen and Crescent and the Illinois Central. Many others are laying plans for entering the city. As with most Western and Southern States now, rates are fixed by railroad commission. New Orleans is the third port in the United States in amount of foreign commerce, next to New York and Boston. For the year ending 30 June 1909 its imports and exports (principally the latter) amounted to over $190,000,000. For the year ending 30 June 1917 its imports were $104,517,000 and exports $303,510,000. In the year 1917 there were entered ships of a tonnage of 2,883,117 and cleared 3,018,989.

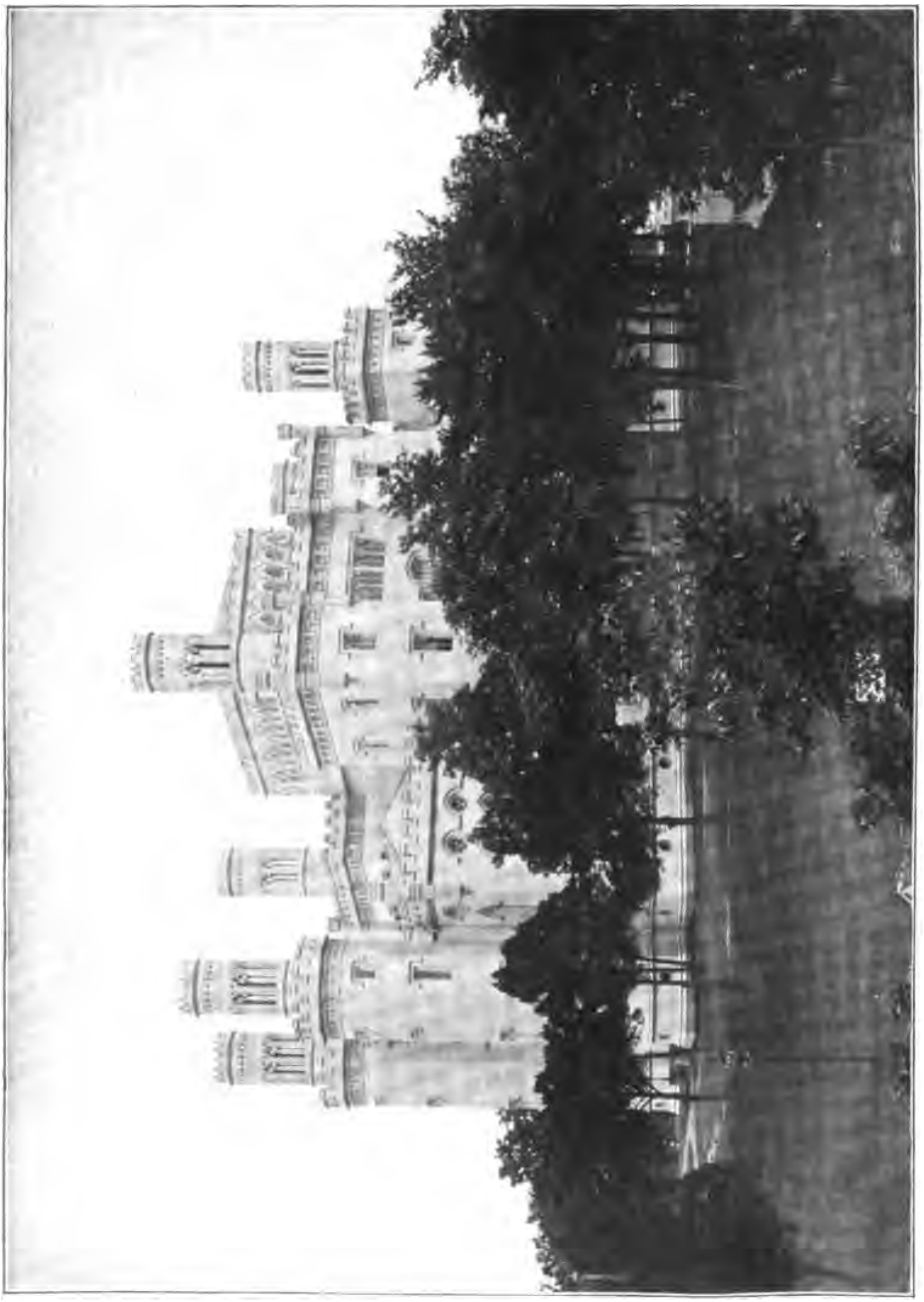
Banks.— The State has an excellent banking system, very conservative in its holdings of reserves; the New Orleans banks were notable for their exceptional solidity and punctuality in meeting Northern obligations when the Civil War broke out. On 18 Sept. 1916 there were in operation 219 State banks with resources of $221,316,903,000. There were also 14 stock savings banks with 100,000 depositors and $33,863,885 deposits. In the year 1918 the exchanges at the United States clearing-house at New Orleans were $1,799,857,000.

Government and Finance.—The constitution of 1898 was devised to exclude the illiterate negro vote, except for owners of property to over $300 who are not subject to educational qualification. Otherwise than that, each voter must be able to fill out his application blank for registration, but this does not apply to anyone who was a voter on 1 Jan. 1867 (that is, before the 14th or 15th Amendment was passed), or his son or grandson of mature age. Women taxpayers can vote on all questions of taxpaying in any subdivision of the State. State officers are elected for four years. The governor has $5,000 salary, the pardoning power and a veto by items, which may be overridden by a two-thirds vote of the elected members of each house. The legislature holds biennial sessions limited to 60 days; both houses are elected for four years; the senate may be from 36 to 41 in number, the house from 98 to 110, and as a fact the numbers are now 39 and 114; there must be one representative to each parish, and to each ward of New Orleans. The judiciary is headed by a Supreme Court, consisting of a chief justice and four associates appointed by the governor with the consent of the senate, for 12 years. There are judicial districts, to be not less than 20 nor more than 29; the judges are elected for nine years, as is the district attorney for each.

From and after 1 July 1904 there has been a Court of Appeals, composed of two district judges designated by the Supreme Court. The State has a large Democratic majority. It sends two senators and seven members to Congress. The assessed valuation of property in 1918 was $1,412,552,191; the State tax is $5 per $1,000. The legislature cannot incur debts except to repel invasion or suppress insurrection. A poll-tax on each adult male goes to the school fund (see *Education*). The bonded debt for the fiscal year 1918 was $11,108,300. The budget for 1918 was $6,993,527.

Education.— Louisiana, formerly near the foot of the ladder in the general education of its people, has made extraordinary efforts in the past two decades, and in some respects has surpassed all other Southern States; a fact more creditable from its large negro population. The average school term (191.4 days) was the longest of any Southern State. The term of colored schools was as long as those of the white, and the amount expended is exceedingly creditable, being in 1915, $5,961,596.86, or nearly half as much as the current receipts of the State. The school revenues are made up of 1 13/20 mills from the State property tax of six mills on the dollar, a poll-tax of $1 13/20 on all males over 21 — retained in the parish where levied, and other local taxes may be laid — special corporation taxes, etc. By the law of 1902 the school administration is centralized in a State board of education consisting of the governor and eight appointees, the superintendent of education and the attorney-general; this appoints a four-year board of education for each parish (county), who appoint parish superintendents. The enrolment in schools during 1915 was 63 per cent of the white children from 6 to 18, and 40 per cent of the colored; in both cases more than a threefold increase in 20 years. Despite all efforts, however, the load of illiteracy is a heavy one to struggle against. In 1915 there were 5,658 teachers, nearly three-fourths female; over 1,176 colored teachers, about evenly divided. Besides

LOUISIANA



State Capitol at Baton Rouge

these there were many hundred private teachers. The pupils in the Catholic schools alone were about 25,000. Total pupils enrolled in common schools were 254,861. For higher education there were 38 public and 135 private high and secondary schools, two industrial colleges, the Industrial Institute at Ruston (North Louisiana) and the Southwestern Industrial Institute at Lafayette, two normal schools, the State at Natchitoches and that of the city at New Orleans; the State University and Agricultural and Mechanical College at Baton Rouge, partly supported by the United States; Tulane University, with affiliated special colleges, one of the best reputed institutions in the South, and a number of Roman Catholic and sectarian colleges. For the colored people are four — Southern University, Leland University, New Orleans University and Straight University.

Charitable and Penal Institutions.— The State Board of Charities and Corrections can only inspect and report. The old system of leasing out convicts to private contractors was abolished by the constitution of 1898, and they are now only employed on public works or convict farms, or in manufactures owned and operated by the State; and parish jail inmates may be employed on public works within that parish. The State Insane Asylum is at Jackson, a Lepers' Home in Iberville Parish, institutions for the deaf and blind at Baton Rouge and there are State hospitals at New Orleans and Shreveport. The health of New Orleans is regulated by a board of health composed of three members appointed by the New Orleans city council.

Churches.— The strongest denominations in order of church societies are the Baptists, Southern Methodists, the two forming the bulk of the Protestants, Roman Catholics, Presbyterians, Protestant Episcopalians, Lutherans and Unitarians. The Roman Catholics are stronger here from the long Spanish and French domination than anywhere else in the South. In New Orleans are located a Roman Catholic archbishop and bishops of the Protestant and Methodist Episcopal churches. There are also Roman Catholic bishops at Natchitoches and Lafayette.

History.— The earliest knowledge of Louisiana dates from the discovery of the mouth of the Mississippi in 1528 by Narvaez. De Soto, 13 years later, crossed the great river on rafts at some point about the Arkansas; of the importance of this discovery the Spaniards were wholly ignorant. The next Europeans to sail on the great river were the French. In 1673 Marquette and Joliet were sent by the governor of Canada to seek the river which might lead to the great western ocean. They descended as far as the mouth of the Arkansas. In 1682 they were followed by La Salle, who completed the work of discovery and took possession of the country, which he called Louisiana, in the name of Louis XIV. In 1684 he sailed from France with colonists to form a settlement. He missed the mouth of the river, landed at Matagorda Bay and was murdered in 1687. Brave men were not lacking to take up the enterprise, and in 1698 Iberville, with his brother, Bienville, sailed from Brest for the Mississippi. Finding the Spanish in possession of Pensacola, he stayed for a short time at Mobile and then entered and explored the lower part of the rivers. His first settlement was at Biloxi, despite the protest of the Spanish governor of Pensacola. In 1702 the site of the colony was removed to Mobile. Antoine Crozat obtained the concession of Louisiana in 1712. It was handed over for 25 years to the Western or Mississippi Company, founded by John Law. Bienville was again made governor and was able to carry out his long-formed plan to create a city where is now New Orleans. Later, in 1722, he was able to make it the capital of the colony. The Western Company sent out large numbers of emigrants, and the colony increased in population, but not in prosperity; misgovernment and Indian wars prevented all progress. In January 1732 Louisiana was surrendered to the king. Iberville resigned in 1743 and was succeeded by Vaudreuil, under whom were issued levee ordinances and police regulations for New Orleans. In the following years there was no improvement in the condition of the colony, of which the annual expense was a drain on the exhausted resources of France. In 1762, by the Treaty of Fontainebleau, Louisiana west of the Mississippi, together with the island of Orleans, was ceded to Spain, and in the next year Louisiana east of the Mississippi, together with Florida, was surrendered to Great Britain by the Treaty of Paris. The dissatisfaction of the Louisianians and the long delay of Spain in taking possession of her new colony gave rise to a serious revolt which was sternly suppressed by O'Reilly. He, however, provided for a form of government under which the colony made considerable progress. The great growth of the population on the upper Mississippi caused a demand for freedom from all restrictions of commerce on the river. This was obtained temporarily by concessions from the Spanish governors, but when the right of deposit was refused in 1803, there was grave danger of a descent on New Orleans. The desire of Napoleon to create a colonial empire in America led to the secret Treaty of Saint Ildefonse in 1800, by which France acquired that portion of Louisiana formerly ceded to Spain. In 1803 fear of English invasion induced Napoleon to sell Louisiana to the United States for $15,000,000. (See ANNEXATION; LOUISIANA PURCHASE, for statistics of size and location). On 28 March 1804 the part south of lat. 33° N. was organized as Orleans Territory; the northern part being organized as Louisiana Territory, afterward changed to Missouri Territory. An enabling act was passed 20 Feb. 1811 to form Orleans into a State, and it was admitted 8 April 1812. The French element was so strong that the constitution allowed members of the legislature to debate either in French or in English, and the dividing line in politics was usually between the two, wth temporary alliances of other elements. The organization of the Whig party, one of whose cardinal tenets was protection, which helped sugar, turned Louisiana into one of the strongest Whig States in the South, she twice voting for Whig Presidents. The slavery issue, after 1860, made it more and more strongly Democratic, and in 1860 it was heavily for secession. New Orleans was captured by the Federal troops 25 April 1862, and the State government, whose seat had been Baton Rouge since 1852, was transferred to Opelousas. During the rest of the war the territory held by the Federals was recognized as the legitimate State government, though under a military governor, and sent members to Congress. On 30 July 1866 an attempt of the colored leaders to hold a constitutional convention at New Orleans and secure the admission of their race to the franchise resulted in the massacre of many of the delegates by the whites, which had much to do with the excessive severity with which the subsequent Reconstruction government bore on the latter. (For the general history of the time, see RECONSTRUCTION. For the part borne by the State in the imbroglio of 1876, see ELECTORAL COMMISSION). The most important item in the subsequent history was the passing of the Constitution of 1898, with the "Grandfather Clause," to disfranchise the negroes, which reduced the negro registration to about 7,000, as against over 120,000 whites.

Governors of Louisiana

TERRITORY OF ORLEANS

William C. C. Claiborne		1804–12

STATE

William C. C. Claiborne.	Democratic Republican.	1812–16
Jacques Philippe Villere.	" "	1816–20
Thomas B. Robertson	" "	1820–24
Henry Schuyler Thibodeaux (acting)	" "	1824
Henry Johnson	" "	1824–28
Pierre Derbigny	" "	1828–29
Armand Beauvais (acting)	" "	1829–30
Jacques Dupre (acting).	" "	1830–31
Andre Bienvenu Roman.	Whig	1831–35
Edward E. White	"	1835–39
Andre Bienvenu Roman.	"	1839–43
Alexander Mouton	"	1843–46
Isaac Johnson	Democrat	1846–50
Joseph Walker	"	1850–53
Paul Octave Hebert	"	1853–56
Robert C. Wickliffe	"	1856–60
Thomas O. Moore	"	1860–62
George F. Shepley	Military	1862–64
Henry W. Allen	Governor of Confederate part of State	1864–65
Michael Hahn	Unionist and Military	1864–65
James M. Wells	Democrat	1865–67
Benjamin F. Flanders	Military	1867
Joshua Baker	"	1867–68
Henry C. Warmoth	Republican	1868–71
John McEnery	Democrat and Liberal Republican. Not recognized by President or Congress	1873
William Pitt Kellogg	"Custom House" Republican	1873–77
Stephen B. Packard	Republican claimant; not recognized	1877
Francis T. Nicholls	Democrat	1877–80
Louis A. Wiltz	"	1880–81
Samuel D. McEnery	"	1881–88
Francis T. Nicholls	"	1888–92
Murphy J. Foster	Anti-Lottery Democrat.	1892–1900
William W. Heard	Democrat	1900–04
Newton C. Blanchard	"	1904–08
Jared Y. Sanders	"	1908–12
Luther E. Hall	"	1912–16
Ruffin G. Pleasants	"	1916–

The following are the names of the principal authors who have written on Louisiana: *History:* Le Page du Pratz, Villiers du Terrage, Martin, Gayarre, Fortier. *Description:* Darby, Stoddard. *Botany:* Rafinesque, Chapman. *Ornithology:* Audubon. *Literature:* Fortier. *History and Development of New Orleans:* Cable, King, Castellanos.

For official information consult reports of State officers published at Baton Rouge and of Chief of Engineers, Washington, D. C.

Population.— The census figures from 1810, when it was first counted separately as the Territory of Orleans, are as follows: (1810) 76,556; (1820) 152,923; (1830) 215,739; (1840) 352,411; (1850) 517,762; (1860) 708,002; (1870) 726,915; (1880) 939,946; (1890) 1,118,587; (1900) 1,381,625. In 1910 it was 1,656,388, an increase of 19.9 per cent. The foreign born were 52,903, of whom 17,431, or about one-third, were Italians, 12,604 Germans, 6,500 French and 6,436 Irish. The colored population was 650,804, or nearly half, a relative decrease since 1890 of over 12 per cent, due to the higher death rate among the negroes. Louisiana was sixth in absolute number of colored inhabitants and third in relative number, next below Mississippi and South Carolina. The population in 1918 was 1,884,778. The legislature is forbidden to create new parishes with less than 625 square miles and 7,000 inhabitants, or divide an old parish so as to leave either portion less than these magnitudes. There are no large cities, except New Orleans with 287,104 people, in 1900, and in 1910 over 339,075, in 1917, 371,747; the great Mississippi port, and destined to a much larger growth. Shreveport, the next, on the upper Red River, had 28,015; Baton Rouge, the capital, on the Mississippi, 14,897. The only others above 5,000 are New Iberia in the south and Lake Charles in the southwest and Monroe in the northwest, Alexandria on the lower Red River and Minden east of Shreveport.

Sociology.— Owing to the preponderance of population and the general importance of New Orleans it has been found useful to locate these institutions usually found at the State capitol. The Supreme Court sits in the newly built Law Courts, in which is the State Library. The two most important libraries in the State are the Howard Memorial Library for reference and the New Orleans Public Library for circulation established, which provide for the public of New Orleans the use of nearly 100,000 books. There are published in the State 188 newspapers, of which the New Orleans *Times-Picayune* is the most important daily. The literature of the State consists of two groups of writings: the one in French covering the period between 1835 and 1855, including those of Gayarra and Rouquette, and a brilliant series of works in English prose and poetry by Townsend, King, Davis, Fortier, Ficklen, etc., which have been produced in the last 30 years of the 19th century.

WILLIAM BEER,
Librarian, Howard Memorial Library, New Orleans.

LOUISIANA, Mo., city, in Pike County, on the Mississippi River, and on the Chicago and Alton and the Chicago, Burlington and Quincy railroads, about 85 miles northwest of Saint Louis. It is situated in an agricultural region, and is the trade centre for a large extent of country in both Missouri and Illinois. Its chief industrial plants are flour and lumber mills, button factories, brick yards, tools, baskets and lime works, shoe, stove and tobacco factories, wagon and carriage factories. Nearby are large quarries and extensive nurseries. The trade is chiefly in its manufactured articles, dairy and nursery products, grain, fruit and livestock. There is a good public library. Pop. about 4,454.

LOUISIANA, Code of. In the history of law in the United States the first important experiment with a code in the United States was made in Louisiana, which State, originally a French colony afterward ceded to Spain, again returned to France, and subsequently acquired by the United States from France, has had many changes of law. After the United States acquired Louisiana there arose a strong demand for a code, owing to the great confusion of laws. In 1806–08 a code was adopted, but only to supersede the ancient laws when they conflicted with it. A complete civil code was adopted for the State in 1824, which had for its basis the *Code Napoléon*, although some provisions of the common law were injected into it. The Louisiana code was the foundation for a later code prepared for the State of New York under the guidance and supervision of David Dudley Field. This code, although published, and having formed the foundation for many of the codes adopted by the various States, was never accepted by the legislature of New York. See Code.

LOUISIANA, District of. See Orleans, Territory of.

LOUISIANA CREOLES. This appellation belongs exclusively to persons of French and Spanish descent born in Louisiana: notwithstanding the prevalent error to the contrary according it to Louisiana-born children of any European blood. Though often misrepresented, the creoles of Louisiana, as a matter of fact, are intelligent, brave and generous, and are, by no means, inferior in the matter of education; they are also in the enjoyment of the highest social privileges. The women of true creole lineage are world-famed for grace and beauty. The creoles have furnished Louisiana some of its ablest governors, its most distinguished military men, its eminent writers, its leading professional men, financiers and merchants. In 1904 they held a number of the most exalted offices in the State, and were likewise fully represented in all branches of high and meritorious effort. Very many of the creoles now in Louisiana are descended from high and noble families in France and Spain, and they treasure the lofty traditions of their ancestry. The expression «creole negro» is often used, and its employment has perhaps contributed to the false impression which some entertained that the Louisiana creole, truly such, must be, or is, of negro blood. The term under immediate consideration simply means that the negro to whom it is applied, or his progenitors, has been reared under a creole master. So far as the true creole families are concerned, they have been jealous of their Caucasian lineage and careful to maintain the purity of their blood. The word «creole» is often used to designate the origin of certain products of the field and farm, such as creole chickens, eggs, butter, etc. The meaning of this is that the products thus named are strictly from creole portions of the State of Louisiana. A certain debased idiom of the French employed among negroes, and, to some extent, among creole children and lower whites, is popularly called «creole.» It has figured in literature in the shape of short stories, proverbs, etc. The better element of creole adults speak and write the French language in its purity. The majority likewise have a correct and fluent use of the English language. An effective answer to the aspersions, by some sought to be cast upon the character of the olden creoles, is the following citation from the Chevalier Guy Soniat du Fossat, a distinguished officer of the French army who was in New Orleans in 1751. In his ‘Synopsis of the History of Louisiana, etc.,’ he gives the following:

«Creoles are defined to be ‘the children of Europeans born in the colony.’ They, in general, measure about 5 feet 6 inches in height; they are all well shaped, and of agreeable figure; they are lively, alert and agile, and, notwithstanding the great heat of this climate, are laborious. They are born with ambition, and an honest self-esteem. They are endowed with a natural disposition for all sciences, arts, and exercises that amuse society. They excel in dancing, fencing, hunting and in horsemanship. Nature has favored them with a penetrating and active mind, and they are capable of being easily instructed. The lack of teachers renders their education somewhat incomplete, and it must be said, in all justice, that among the many qualities which they possess are politeness, bravery and benevolence. They are good fathers, good friends and good kinsmen.

«The women, besides having the qualities above enumerated, are agreeable in figure and seldom deformed. They make good mothers, and are devoted to their husbands and their children, and in their marital relations seldom are they unfaithful. I must also add that the stranger arriving in this wild and savage country will be surprised to see in this capital, as exists in all countries of Europe, brilliant assemblies where politeness, amiability and gayety reign supreme.»

Bussière Rouen,

Officer d'Académie, Secrétaire perpetuel de l'Athénée Louisianais.

LOUISIANA PURCHASE, The. See United States — Louisiana Purchase, The.

LOUISIANA PURCHASE EXPOSITION, an international exposition held in Saint Louis, Mo., 30 April 1 Dec. 1904, to commemorate the 100th anniversary of the purchase from France of the Louisiana. A tract of 1,142 acres in Forest Park was selected for the site. The plan included 15 large exhibition buildings, of which the main group were laid out in the form of a fan. The apex of the fan was formed of the four great Art Palaces, of which one in brick and stone survives as a memorial. These were from designs by Cass Gilbert. E. L. Masqueray designed the Hall of Sculpture, the Palace of Agriculture and the Palace of Transportation. The Palace of Education was designed by Eames and Young in reformed classic style. Carrère and Hastings designed the Palace of Manufactures in Corinthian. Other groups were the Palace of Electricity by Walker and Kimball, the Palace of Machinery by Widman, Walsh and Boisselier, the Palace of Forestry, Fish and Game by E. L. Masqueray, the United States Government Building, housing exhibits by the various departments of the national government. In addition to these there were about 500 other buildings on the grounds, built by foreign governments, the States and Territories or for special exhibits. The French building was a reproduction of the famous Grand Trianon of Versailles. There were 250 groups of decorative sculpture and over 1,000 single figures, erected under the supervision of A. Saint-Gaudens, J. Q. A. Ward and D. C. French. The landscape effects comprised a six-acre rose garden, sunken gardens and a colossal floral clock. There were several waterfalls and miniature lagoons on which were to be found Venetian gondolas and other watercraft. At the northern end of the grounds there was a street about one mile in length. Along it were leased various amusement concessions. It was known as "The Pike." Perhaps the most interesting and important were the anthropological exhibits of aboriginal tribes, including the Philippine Division which represented all the important native tribes, with exhibits of their domestic life, arts, industries, etc. Of the total recorded admissions, 19,694,855, 12,804,616 were paid.

LOUISIANA STATE UNIVERSITY, the head of the public school system of Louisiana, is located at Baton Rouge, La. The organization of the institution was authorized in the State constitution of 1845. It was to be supported by the income from the sales of the "seminary" land grants. In 1855 the legislature provided for the organization of the institution and its location near Alexandria, La. In 1860 it was opened as the Louisiana State Seminary under the superintendency of W. T. (later General) Sherman. From 1863 to 1865 the institution was closed on account of the Civil War. In 1865 it was reopened under the presidency of Col. David French Boyd, who was for many years afterward president of the institution. Owing to the destruction of the buildings by fire the seminary was removed to Baton Rouge in 1869. In 1870 the name was changed to Louisiana State University and in 1877 it was merged with the Louisiana Agricultural and Mechanical College, which three years earlier had been organized in New Orleans under the "Morrill" Act of Congress (1862) which made grants of public lands for the support of agricultural and mechanical colleges in each State. Since the merger the name of the institution has been Louisiana State University and Agricultural and Mechanical College. The university is now located on the grounds of the old United States military post on the banks of the Mississippi River which were donated to the institution by act of Congress in 1904. The campus contains over 200 acres.

The university is organized into the following schools and colleges: the College of Arts and Sciences; the College of Agriculture; the College of Engineering; the Audubon Sugar School; the Law School and Teachers College. The Law School offers a three-year course leading to the degree of LL.B.; the Audubon Sugar School has a five-year course, in which agriculture and engineering are combined, leading to the degree of bachelor of science; the College of Engineering and the College of Agriculture each offers several four-year courses leading to the degree of bachelor of science; the four-year courses in the College of Arts and Sciences and Teachers College each leads to the degree of bachelor of arts. All of the courses offered by the university are based upon the uniform admission requirement of four years of high school work. A model high school for observation and practice is attached to Teachers College. There is no preparatory department. The total enrolment for 1915–16 was 1,797, distributed as follows: In regular four- or five-year courses, 783; in the Law School, 66; in the Summer Session, 603; in the Farmers' Short Course, 358. The total income for the session 1915–16 from State and Federal grants and other sources amounted to $269,764. In 1915–16 the staff of administration and instruction numbered 100; the research and extension staffs numbered 36, a total of 136 of all grades. A military department is maintained as required by Federal and State law. Graduate courses of one and two years in length are offered leading to the master's degree. The institution is coeducational.

LOUISVILLE, loo'ĭs vil or loo-ĭ-vĭl, Ky., the capital of the county of Jefferson, and the principal city of the State of Kentucky, is situated opposite to the falls of the Ohio River, on the southern shore of the river, on the Louisville and Nashville, the Southern, the Chesapeake and Ohio, the Baltimore and Ohio Southwestern, the Pennsylvania and other railroads, 110 miles south of Cincinnati.

Falls of the Ohio.— The falls of the Ohio River are caused by a ledge of Devonian rocks, rich in corals and other fossils, which were lifted from the bottom of the Silurian Sea, in which they were formed, and left here thousands of feet above their place of formation. In ancient geological times this wall of rock, in the form of an anticlinal axis, dammed up the water 25 feet and formed a lake a mile wide and several miles in length, above the dam, while the water below rushed down the other side of the axis, at the rate of a dozen miles an hour, until it was lost in a seething whirlpool below. When the river was low, it was dangerous to attempt to conduct a boat over these falls, but when it was high, on account of the narrowness of the stream below and its width in the lake above, the excess of water filled the narrower stream below to a level with the wider one above and vessels passed over the falls as if they had not been there. In 1830 a canal two miles long was finished around the falls, on the Kentucky side, and on the 5th day of December the steamboat *Uncas* passed through it. The canal has since been enlarged and improved so as to meet the wants of the largest boats and is always used in going over the falls in low water.

Plan of Louisville.— The plan of Louisville as originally laid out by John Corbly, in the spring of 1779, consisted of one range of streets parallel with the river and another range cutting them at right angles. The streets parallel with the river and running east and west bore names such as Water, Main, Market and Jefferson, while the cross streets were known by numbers, such as One, Two, Three, etc. This plan was adhered to until additions to the original boundary made it necessary or gave an excuse for laying out new streets differently. In some of the additions the streets now run in all directions. Broadway as originally laid out is 120 feet wide; Main, Market and Jefferson each 90 feet, and the other streets with a few unimportant exceptions 60 feet in width. In 1813 the paving of streets began. Previous to this time they were mud holes in winter and dirt-piles in summer. That part of Main street from Third to Sixth was paved after the McAdam style. There are now in the city about 200 miles of streets and as many miles of alleys paved with vitrified brick, asphalt, granite or boulders, and a few with broken stone after the McAdam fashion.

Original Area of Louisville.— The original tract of land given to Louisville for a site by the legislature of Virginia contained 1,000 acres. The land cost the State of Virginia nothing because it was confiscated from Dr. John Connolly, an adherent of the British during the War of Independence. The legislature simply took the land from Connolly and gave it to Louisville. The city has since added many other tracts of land to the original until its external boundary now embraces 27 square miles.

Dwelling-houses.—The first dwelling-houses built in Louisville were 16 by 20 log cabins with board roof and puncheon floor where there was any floor at all, but in many instances the native earth was the floor. Louisville is to-day distinguished for no one thing more than for the handsome and comfortable dwelling-houses of her citizens.

Business Houses.— The few rude dwellings were promptly followed by business houses equally rude if indeed the cabin used for a dwelling was not at the same time used for a shop or manufactory. Michael Humble so soon as the town was laid out erected a cabin near the fort at Main and Twelfth streets in which he made and mended guns and wrought out of metal the few things that were used. Joseph Cyrus had next to him a shop in which he made spinning-wheels and looms and everything that was carved out of wood. George Vensonier followed next with a tailor's shop and Henry Duncan with a hat-shop. A little further up town, between Fifth and Sixth streets, Daniel Brodhead had a store in which every kind of article used in the community was sold over the same board counter. These were humble beginnings at manufacturing, but they continued to increase until now, according to the census, we have in Louisville 800 manufacturing establishments which turn out manufactured articles valued at $101,000,000 annually. Our pioneers who were used to log cabins for all purposes could not conceive of the necessity of the modern establishments if they were to behold them now in use, built of stone or brick, some covering whole squares and others ribbed with steel ascending into the clouds. The public buildings of the city have proportionately increased in dimension and style until they have become real ornaments. The courthouse with its severe classic features, the city hall in its Gothic outlines, the custom-house in its blended styles of architecture, the sky-scrapers at the corner of Fourth and Main, and Main and Market, some of the great tobacco warehouses on Main street and many of the manufacturing establishments and stores in different parts of the city are fine specimens of architecture adapted to the wants of business. The Galt House on the corner of Main and First is one of the finest hotels in the country and a new hostelry has just been erected on Fourth street which ascends high into the air and meets every want of the guest. A new jail has been erected on the site of one of the early churches which will not only rob the prison of some of its horrors, but will be an ornament to the city. The great department stores by furnishing the purchasers with every want have revived the fashion of pioneer times when every article which was for sale was sold under the same roof and made shopping a delight rather than a burden. The building of the American National Bank on the corner of Third and Main and that of the Louisville Trust Company at Fifth and Market are palatial business houses, well suited to the purposes for which they were erected as well as ornaments to the city.

Education.— Louisville as an educational centre is surpassed by but few cities. The University of Louisville with its law and medical departments, the Female High School, the Male High School, the Manual Training School and the Normal School, which are colleges of a high order, the ward schools where children are trained free of cost for the higher departments, the medical colleges, the theological seminaries, the musical societies, the Catholic institutions and the educational associations in some of which the sciences are taught, all together offer advantages to students in almost every branch of knowledge. The Male High School, the Female High School, the Normal School and the Manual Training School, like the ward schools, are free institutions entirely supported by the city.

Charitable Institutions.— Hospitals, asylums and homes are almost as numerous in Louisville as schools. The Children's Free Hospital, where afflicted little ones are cared for, the Kentucky Institute for the Blind, where the sightless are taught to read and write, and 51 other institutions maintained for different purposes are prepared to meet almost every form of infirmity.

Churches.— There are 265 churches in Louisville, representing nearly all denominations. The principal denominations are the Baptists, the Methodists, the Presbyterians, the Christians, the Episcopalians, the Catholics and the Lutherans, but there are also Unitarians, Evangelists, Jews, and those who call themselves Non-Sectarians, Scientists, Seventh-Day Adventists, Social Settlements, Spiritualists, Swedenborgians, United Brethren and Theosophists. Some of the houses of worship, like the cathedral of the Assumption, the Warren Memorial, the Third Avenue Baptist and the Fourth Street Christian, are fine specimens of ecclesiastical architecture and capable of seating large congregations.

Banks.— There are 14 banks and banking institutions in Louisville with a combined capital of about $7,000,000 and a surplus of half as much more. If the trust companies and title companies which necessarily do a good deal of banking business are added to the banks the capital and surplus of all combined will exceed $15,000,000. A farm loan bank was established here in 1916. Bank clearings are about $750,000,000 yearly.

Finances.— The finances of Louisville will compare favorably with those of any other municipality. According to the last published report of the assessors the assets of the city amounted to $17,442,552 and the liabilities to $8,836,129. If the liabilities therefore are deducted from the assets, a balance of $8,616,422 will remain in favor of the city. The city, moreover, besides owning this large amount of property in its own name has an income from taxes sufficient to meet all of its fixed liabilities and current obligations. The property within the city limits owned by individuals is assessed at over $207,000,000. The charter only allows 95 per cent of this amount to be considered in providing for current expenditures to be expended by the city during the year. The annual revenue from all sources exceeds $11,250,000. The tax rate averages about $1.79 for all purposes. This amount is distributed through the different departments of the city so as to provide for every liability and at the end of the year balances are generally left in different departments which are again distributed.

Largest Industries.— The largest industries are tobacco, cement, wagons, plows and leather. More leaf-tobacco is handled here than in any part of the world. The quantity of hydraulic cement and plows and wagons and leather made here is also enormous. The Board of Trade gives the following figures for 15 leading articles:

Agricultural implements — pounds	40,000,000
Boots and shoes — cases	114,000
Dry goods and notions — cases	678,000
Flour — barrels	710,000
Furniture — pounds	30,000,000
Hardware — cases	985,000
Fine leather — pounds	11,500,000
Saddlery — packages	255,000
Stoves and stove castings — pounds	29,500,000
Soap — pounds	27,000,000
Manufactured tobacco — pounds	52,000,000
White lead and paints — pounds	17,500,000
Wagons — pounds	35,900,000
Whisky — barrels	365,000
Woolen goods — pounds	15,000,000

Water.— The city owns the works which supply the citizens with water. A filter, costing $3,000,000, has been added to the plant. The water is sold to the citizens at a price much lower than they could obtain it in any other way.

Light.— The citizens have choice of three kinds of light furnished by different companies: these are electricity, artificial and natural gas. Natural gas is also much used for heat on account of its cleanliness and convenience.

Street Railways.— Street railways on which cars run by electricity reach every part of the city and extend into the suburbs and to distant neighboring towns. There are over 300 miles in operation.

Steamboats.— Steamboats with headquarters at Louisville, in spite of the interference of railroads, are yet seen upon the Ohio and other Western waters, and afford cheap rates of freight. There are not, however, so many floating palaces upon the Western rivers as there were before railroads came into use, but there are yet a few which prevent the Ohio and its glories of old from being forgotten.

Board of Trade and Commercial Club.— There is a board of trade which keeps an eye on the interests of Louisville, and a commercial club which helps in the work. Any enterprise which looks to the interests of the city can be brought before either or both of these associations and secure recognition and help if deemed worthy. Both of them have done valuable work in behalf of the city.

Newspapers.— There are five daily newspapers, three issued mornings and two evenings. Many weekly, semi-weekly, monthly and periodical sheets are also issued. The *Courier-Journal* and *Herald* appear mornings and the *Times* and *Post* evenings.

Libraries.— The only public library in the city is the Louisville Free Public Library, successor to the Polytechnic Library, which was in turn successor to the Public Library of Kentucky. It has some 177,000 volumes on its shelves, and its present equipment is due to the generosity of Andrew Carnegie. The Southern Baptist Theological Seminary has a valuable library at the corner of Sixth and Broadway, and there are several other smaller collections which have something of a public character. There are also several large libraries in the city which belong to private citizens, and one of these, which has upon its shelves some 50,000 volumes, is one of the largest private collection in the country.

Sewers.— The sewerage system of Louisville is extensive. The early engineers were disposed to do all the draining of the city toward "Paddy's Run," a probable survivor of the Ohio when its channel was farther to the south. This system, however, had to be abandoned when it was found that Paddy's Run would itself have to be drained as the city enlarged. The present sewerage system terminates in the Ohio River, where it should have gone at first.

Fire Protection.— The fire department of the city, under a chief, several assistants and firemen, has a modern equipment of steam engines, chemical engines and all the necessary accompaniments of water-towers, hooks and ladders, etc. It is kept up at an annual expense to the city of about $320,000.

Police.— The police force is maintained at an annual cost of about $436,000. The members are arranged after somewhat of a military grading, and consist of one chief with the rank of colonel, one assistant with the rank of major, captains, lieutenants, sergeants, corporals, chief of detectives, detectives, special detectives, district detectives, mounted men, station-keepers, wagoners, patrolmen and a secretary.

Parks.— The parks of Louisville have only been established in recent years. The present system was organized in 1891, and lands purchased for an eastern, a southern and a western park. There was no use for a northern park, as the river was on that side. The western, known as Shawnee Park, consists of comparatively level land and embraces 180 acres; the eastern, named Cherokee Park, has 409 acres of gently rolling land cut into picturesque ravines by Beargrass Creek; and the southern, called Iroquois Park, contains 676 acres of land, partly level, but mostly hilly, with some of its eminences nearly 300 feet into the air. The park commissioners purchased of the Dupont estate 18 acres known as Central Park, which, added to Baxter and Boone squares, will enlarge the intramural part of the system and meet the wants of those who cannot enjoy the suburban parks. The parks were named after the three Indian tribes who once asserted ownership over the land.

History.— In 1773 Dr. John Connolly located 2,000 acres of land, to which he was entitled for military service in the French and Indian War, on the south side of the Ohio River, immediately opposite the falls. This land was surveyed for him by Capt. Thomas Bullitt, and on 10 Dec. 1773 Lord Dunmore executed a deed to him for it. Connolly then conveyed to Col. John Campbell one-half of this land, and the two undertook to establish a town thereon, which Bullitt had laid out in the original survey. In 1774 they advertised lots for sale, but Indian disturbances arose and no one came to buy the lots. To the Indian troubles difficulties between Great Britain and her colonies succeeded, and increased until actual war was on between them. Connolly, as an adherent of England, was arrested by the patriots and thrown into prison, and Campbell fell into the hands of hostile Indians on his way from the Falls to Fort Pitt. Under such adverse conditions, with both proprietors in prison, the projected town at the Falls came to an end, and was probably forgotten by all except the unfortunate projectors.

In the spring of 1778, while Gen. George Rogers Clark was floating down the Ohio with his boats loaded with soldiers for the conquest of the Illinois country, he felt the necessity of some safe place in which he could discipline his raw recruits. When he reached an island in the midst of the Falls, afterward known as Corn Island, and saw the rapid waters dashing around it, he concluded that was the place he wanted, and that no deserter could make his escape from this island. Hence he landed on this island, on 27 May 1778, and immediately went to work to erect cabins for some 20 families of emigrants who came on his boats, and a blockhouse for his soldiers and supplies. He was opposed to these families coming on his boats, but was glad they had come, as he could leave the supplies he could not take with him in their care on the island and thus take with him every soldier. At the end of a month he thought his raw troops had been disciplined enough to make them reliable soldiers and moved off with them down the river to Fort Massac, leaving the emigrants on the island, while the sun was in a full eclipse. The families thus left on the island became the founders of Louisville. So far as has been ascertained, there were about 50 in number, consisting of men, women and children and one negro. They remained on the island until the news came that General Clark had conquered Kaskaskia, Vincennes, etc., and put an end to the Indian raids that came from the British posts there to prey upon the helpless families of the Virginia border. Then, by order of General Clark, they built a fort on the main shore and moved into it in time to celebrate their first Christmas in the wilderness with a dinner and a dance.

The interest attached to the subject among the descendants of these founders of Louisville, who are numerous, will justify the record of their names here for the preservation of their memories. So far as has been ascertained they were the following:

James Patton, his wife, Mary, and their three daughters, Martha, Peggy and Mary.

Richard Chenowith, his wife, Margaret, and their four children, Mildred, James, Jane and Thomas.

John McManess, his wife, Mary, and their three children, John, George and James.

John Tewell, his wife, Mary, and their three children, Ann, Minnie and Jessie.

William Faith, his wife, Elizabeth, and their son, John.

Jacob Reager, his wife, Elizabeth, and their three children, Sarah, Mariah and Henry.

Edward Worthington, his wife, Mary, his son, Charles, and his two sisters, Mary (Mrs. James Graham) and Elizabeth (Mrs. Jacob Reager).

James Graham, his wife, Mary.

John Doune, his wife, Martha, their son, John, and their colored man, Cato Watts.

Isaac Kimbley, and his wife, Mary.

Joseph Hunter and his children, Joseph, David, James Martha (Mrs. John Doune) and Ann.

Neal Dougherty, Samuel Perkins, John Sinclair and Robert Tevis.

The above-named persons who came to the Falls with General Clark and those who joined them as immigrants in the following spring held a public meeting 10 April 1779 and appointed William Harrod, Richard Chenowith, Edward Bulger, James Patton, Henry French, Marsham Brashears and Samuel Moore trustees to lay out a town. These trustees met on 17 April 1779, and, having agreed upon a plan of the town, named it Louisville and employed John Corbly, a surveyor, to lay it out and make a map of it. The plan of the town, as mapped out by Corbly, consisted of nothing but one street running along the bank of the river and 12 cross-streets cutting in at right angles.

On 1 May 1780, the legislature of Virginia, in response to a petition of those who had laid out the town, confirmed their act and appropriated 1,000 acres of the land which had been forfeited from Connolly, for the benefit of the town. The same act of the legislature appointed nine trustees to manage the affairs of the town.

The city continued under the government of trustees, either appointed by the legislature of Virginia or Kentucky or elected by the people, from 1780 to 1828.

By the charter of 1828 Louisville passed from the government of trustees to that of a mayor and 10 councilmen. The first election under the charter occurred 4 May 1828, when John C. Bucklin was elected mayor.

The city has greatly prospered since the adoption of this charter, although the charter itself was not of long duration. It was superseded by the charter of 1851, which added to the governing power a board of 12 instead of 10 aldermen, and increased the number of councilmen to 24. It also established the school board, the waterworks, the board of health, the board of police, the board of fire and the sinking fund. A third charter superseded the second in 1870, but the charter which added most to all departments of the city government was that of 1892. Under this charter a score of new departments or bureaus of the city were established. All of them report to the mayor and council, but it takes them all to conduct the affairs of the city.

Population.— In the spring of 1779, joined by other immigrants, the 20 families of immigrants who had come with General Clark laid out a town on the mainland and named it Louisville, in honor of Louis XVI, king of France, who was then helping the colonists in their rebellion against Great Britain. By 1 May 1780 these emigrants had increased possibly to 100, and were at work building log cabins so as to free themselves from the confinement of the fort. By 1790 they had probably increased to 350, and in 1800, when the United States census for the first time recorded the population, but did not give it accurately, they had increased to 600. The population at present is estimated at 235,114.

Consult Casseday, B., 'History of Louisville, from its Settlement till the Year 1852' (Louisville 1852); Allison, Y. E., 'City of Louisville and a Glimpse of Kentucky' (ib. 1887); Powell, L. P., 'Historic Towns of the Southern States' (New York 1900); 'The Book of Louisville and Kentucky' (1915).

LOUISVILLE AND NASHVILLE RAILROAD. The Louisville and Nashville Railroad Company's main lines extend from Cincinnati, Ohio, to Atlanta, Ga., via Lexington, Knoxville and Chattanooga; from Cincinnati to Memphis, Tenn., via Louisville and Guthrie; from Saint Louis, Mo., to Pensacola, Fla., and to New Orleans, La., via Nashville, Birmingham, Montgomery and Mobile, and to intermediate cities.

The road was chartered on 5 March 1850, and the main line was opened to the public in November 1859. The company prospered, and from time to time other branches of the road were built and other systems absorbed, until at the close of the fiscal year ending 30 June 1916 the company operated 5,041.61 miles of railroad, in Illinois, Indiana, Kentucky, Tennessee, Alabama, Florida, Georgia, Mississippi, North Carolina and Louisiana. It also owns a majority of the capital stock or is joint owner or lessee of 2,360.07 miles more railroad lines, comprised in the following roads: Nashville, Chattanooga and Saint Louis Railway, the Birmingham Southern Railroad, the Georgia Railroad and its dependencies, the Atlanta, Knoxville and Northern Railway, and the Chicago, Indianapolis and Louisville Railway, operated under separate organizations. If to this mileage be added that of 41 miles of roads operated by the Louisville and Nashville Railroad, but whose earnings are not included in the earnings of the last-named railroad, and 264.91 miles of branch lines owned but not operated by the Louisville and Nashville Railroad, the grand total of mileage for the Louisville and Nashville system amounts to 7,642.38 miles.

The operating revenue for the fiscal year ended 30 June 1916 was $60,317,993, earned by the transportation of 11,925,101 passengers and 35,488,688 tons of freight. The passenger travel averaged 44.40 miles, at a charge of 2.17 cents per mile — aggregating in the year 529,426,981 miles, and $11,488,086. The freight traffic averaged 183.49 miles per ton, at a charge of 0.686 cents per ton mile — aggregating in the year 6,511,946,570 ton-miles, and $44,658,860.

The operating expenses for the year were $39,790,481. After deducting taxes and uncollectible revenue, the total operating income was $18,265,906. Interest on funded debt amounted to $7,681,718, and the total non-operative income was $4,456,167. The total net income from all sources was $14,039,130, of which $13,953,849 was transfered to profit and loss account. The dividend appropriations from surplus amounted to $4,320,000.

The equipment of the system on 30 June 1916 consisted of 1,042 locomotives, with an aggregate tractive capacity of 32,593,600 pounds; 392 passenger cars; and 45,761 freight cars, of which 20,368 were coal cars with an aggregate capacity of 894,462 tons. Bituminous coal constitutes the largest item of freight tonnage, amounting to 13,943,804 tons, or 40 per cent of all the freight handled. The operating revenue per mile of road was $11,964, and the operating expenses $7,892, making the net operating revenue per mile of road $4,072.

The entire investment in the road and its equipment on 30 June 1916 was $271,683,491. Other investments of the company amounted to $35,026,729. The total stock outstanding on the date mentioned was $72,012,117, and the total long-term debt was $178,230,412. Accrued depreciation was placed at $31,538,865. The credit balance of the profit and loss account on the same date was $50,172,752.

The Louisville and Nashville Railroad Company owns but does not operate the Yellow River Railroad of Florida, a short line of less than 30 miles, operated independently. It also leases or operates the following roads, whose earnings are not included in the income account of the lessee company: The Eastern Railroad of Alabama, about 20 miles of lines; the Elkton and Guthrie Railroad of Kentucky, about 11 miles of lines, and the Glasgow Railroad of Kentucky, about 10 miles of lines.

On 30 June 1916, $36,720,000 of the capital stock of the Louisville and Nashville Railroad was owned by the Atlantic Coast Line Railroad Company.

LOULANGES CANAL. See CANADIAN CANALS.

LOULÉ, lō-lā, Portugal, town in the district of Faro, 10 miles from the seaport of Faro. It contains many interesting remains, including its old walls and towers of the Moorish period, the pilgrim church of Nossa Senhora da Piedade. Copper and silver mines are worked nearby. Basket-making is the chief industry, but there are also manufactures of leather, porcelain and esparto grass and palm products. Pop. 19,680.

LOULÉ, lo-la', MARQUIS OF, Portuguese nobleman and statesman: b. Lisbon, 1785; d. 1824. His early education was received in company with John VI. In 1807 Loulé was given the title of Marquis and was placed in command of the Portuguese army which formed part of the great force collected by Napoleon I in the Peninsular War. Loulé later joined John VI in Brazil and when that monorch returned to Portugal Loulé accompanied him. The Absolutists were antagonized by his loyalty to the king and by his liberalism and through devious means effected his assassination.

LOUNSBURY, lownz'ber-ĭ, **Thomas Raynesford,** American scholar: b. Ovid, N. Y., 1 Jan. 1838; d. 9 April 1915. He was graduated at Yale in 1859; in 1862 he enlisted as a volunteer in the Union army and served as 1st lieutenant of the 126th New York Volunteers. He was mustered out at the close of the war, and, after private tutoring for three years, became in 1871 professor of English in the Sheffield Scientific School of Yale University. For 33 years he was also librarian of the school. He retired from active service in June 1906. He was a member of the American Academy of Arts and Letters. He became well known as a student and critic of Chaucer and Shakespeare. He edited Chaucer's 'House of Fame' and 'Parlement of Foules' (1877); 'Works of Charles Dudley Warner' (1904); 'Yale Book of American Verse' (1912), and is the author of 'History of the English Language' (1879); 'James Fenimore Cooper' in 'American Men of Letters' series (1883); 'Studies in Chaucer, his Life and Writings' (1892); 'Shakespeare as a Dramatic Artist' (1901); 'Shakespeare and Voltaire' (1902); 'The Standard of Pronunciation in English' (1904); 'The Text of Shakespeare' (1906); 'The Standard of Usage in English' (1908); 'English Spelling and Spelling Reform' (1909); 'Shakespeare as a Dramatic Artist' (1912).

LOURDES, loord, France, town, in the department of Hautes-Pyrénées, on the Gave de Pau, about 85 miles southeast of Bayonne. It is situated where seven mountain passes lead to favorite resorts in the Pyrenees. Nearby are valuable marble and slate quarries. Formerly Lourdes was famed for its chocolate and its fortified castle, which was considered impregnable in the days before the invention of firearms. Lourdes was then called the «key of the Pyrenees.» In the 18th century the castle was converted into a prison and became the Bastile of the Mountains. In the year 1858 Lourdes acquired new fame. A little peasant girl, about 14 years of age, named Marie-Bernarde Soubirous (better known as «Bernadette») reported to her parents, on 11 Feb. 1858, that she had seen a most beautiful lady in a grotto at the rocks of Massabielle, a part of the town. The pastor of the Roman Catholic church at Lourdes, and the priests of the neighboring towns, also the bishop of Tarbes, the diocese in which Lourdes is located, all gave the matter no attention until people from a distance began to visit Lourdes, and miracles were reported and scientists had begun observations and investigations. On 25 Feb. 1858 a spring appeared in a place where no water had been seen before. It was some days before the child gave a name to the lady; it was then Virgin Mary, under the name L'Immaculatée Conception. The matter was then investigated by the ecclesiastical authorities and pronounced a genuine apparition and many cures were said to be miraculous. The place has become noted for the large number of visitors, fully 600,000 annually. A magnificent church, the Basilica of the Rosary, has been erected at the grotto, in which there is a great collection of votive offerings, and the flags of all nations show that pilgrims from the countries of the whole world have visited the place. The prosperity of the town is dependent on the pilgrims. Pop. about 8.805.

Consult Benson, R. H., 'Lourdes' (London 1914); Bertrin, 'Histoire critique des événements de Lourdes' (2d ed., Paris 1905); Boissaire, 'Lourdes histoire médicale' (ib. 1891); Estrade, J. B., 'Appearances of the Blessed Virgin Mary at the Grotto of Lourdes' (New York 1913); Saint John, 'The Blessed Virgin in the 19th Century' (1902); Zola, E., 'Lourdes' (Paris 1894).

LOURENÇO, Marques. See LORENZO.

LOUSE, a small parasitic insect of a family (*Pediculidæ*) of doubtful affinities, but usually considered to be *Hemiptera*, much degraded through long-continued parasitism. The lice are all of small size, have soft, much flattened bodies with thin integument, the abdomen enlarged, the thorax indistinctly segmented and without the slightest trace of wings, and the short legs terminated with strongly hooked, stout claws. The mouth-parts are adapted for sucking. There is a short proboscis provided with hooks, from the centre of which, when fixed in the skin of the host, protrudes an extremely delicate tube. The head is also provided with a pair of short, three- or five-jointed antennæ, and small simple eyes. Probably on account of their disgusting habits the lice have been but little studied, and beyond the fact of their parasitism very little is known of their habits. They feed exclusively upon blood, which is secured by wounding the host's skin, fixing the proboscis by means of its hooks, and inserting the delicate tube above mentioned in the wound. A suction-bulb in the head propels the blood through the long writhing œsophagus into the bilobed stomach. Lice never leave their host except to pass to another, and the eggs, as well as all stages of the young, are found with the adult. Only six genera and less than 50 species have been described, but probably many others remain undiscovered. They are found on mammals exclusively, each species of mammal commonly harboring a peculiar species of louse. Man is more richly endowed, having three species: the head-louse (*Pediculus capitis*), the body-louse (*P. corporis*) and the crab-louse (q.v.). The two first mentioned are very closely alike and are said to vary according to the different races of men which they infest. Human lice are of course associated with filth, and are found only upon neglected children and persons of uncleanly habits. A very remarkable louse is found on the seal, and is consequently aquatic.

The bird-lice (q.v.), or *Mallophaga*, are entirely distinct from the true lice.

Consult Piaget, 'Les Pediculines'; Giebel and Nitzsch, 'Insecta Epizoica'; Ealand, 'Insects and Man' (New York 1915).

LOUSEWORT, the plants of the genus *Pedicularis*, of the family *Scrophulariaceæ*, which are low, usually pubescent, perennial herbs, with chiefly pinnatified leaves and spikes of purplish yellow, two-lipped flowers. The species are few in North America, the most common being *P. canadensis*, sometimes called wood-betony.

LOUSIAD, low'zĭ-ăd, **The.** An heroic-comic poem in five cantos by John Wolcott (1785), in which the author ridiculed the home life of George III. The poem, according to the author, was suggested by the presence of a louse on a dish brought to the king's table. An order went forth immediately to shave the heads of the royal scullions.

LOUTH, lowth, England, market town and municipal borough of Lincolnshire, on the river Lud and on the Grimsby branch of the Great Northern Railway, 141 miles north of London. A canal connects it with the Humber. The town contains the fine old church of Saint

James, a town hall, corn exchange, a grammar school, commercial school, a hospital, several almshouses, Thorpe Hall and the ruins of a Cistercian abbey. It has manufactures of agricultural implements, iron foundries and rope and brick-making establishments. There are municipal markets and a cemetery. Louth, according to the Domesday Book, was a borough held by the bishop of Lincoln from Saxon times. It was surrendered to Henry VIII. In 1536 the Lincolnshire Rebellion broke out here. The town was incorporated under Edward VI in 1551 and a new charter was granted in 1830. Pop. 9,880. Consult Goulding, Richard W., 'Louth Old Corporation Records' (Louth 1891).

LOUVAIN, loo-văṅ (Flemish, *Leuven;* German, *Löwen*), Belgium, city in the province of Brabant, on the Dyle, 15 miles east by north of Brussels. It was surrounded by earthen ramparts, which have been converted into pleasant promenades, which form almost a perfect circle, diameter nearly two miles. There are many buildings of historical interest, among which are the Hôtel de Ville, one of the richest and most beautiful Gothic buildings in the world, elaborately and exquisitely decorated in every part of its exterior by sculptures of subjects taken, for the most part, from the Old Testament (restored 1842, injured by lightning 1890); the collegiate church of Saint Peter, almost opposite the Hôtel de Ville, built at the end of the 14th century, an edifice of vast extent, which was rich in works of art, particularly a fine 'Holy Family' by Matsys. The educational institutions were numerous, among them the university, which had a number of American students who were studying for the priesthood. It had an attendance of nearly 3,000 students and a library of 120,000 volumes, specially rich in examples of 15th and 16th century printed books. There are also a college, an academy of fine arts, two normal schools for the training of teachers, several secondary and elementary schools. There are hospitals, homes for orphans and other charitable institutions. It has a number of manufactories, the most important of which are the tanneries. For a general trade the town is well situated, having ample communication both by railroad and the Louvain Canal. The name of Louvain first appears in history about the end of the 9th century. It was surrounded with walls in 1115, but was afterward much enlarged. The dukes of Brabant inhabited the castle till the 13th century. At the beginning of the 14th century Louvain was the capital of Brabant, contained 200,000 inhabitants and had an extensive and flourishing trade in the manufacture of broadcloth and all kinds of woolens. The populace, jealous of the privileges of the nobles, revolted in 1382, and being overcome by Duke Wenceslaus and subjected to severe oppression, emigrated in great numbers to England and thus caused the decay of the town. During the European War Louvain was taken by the Germans on 19 Aug. 1914. After six days of peaceful occupation the Germans advanced beyond the city, but were driven back by the Belgian troops about Malines. Returning to Louvain, the German troops under the command of Major von Manteuffel, began to devastate the city. At midnight the houses were set in flames, while rifle and machine-gun fire swept the streets. The German version stated that the fighting was the outcome of a plot among the civilian population; the Belgians declare that a detachment of German troops, driven back from Malines, was fired upon in mistake by the Germans occupying Louvain. On the 26th fire and destruction continued; the university with its library were set on fire, also the church of Saint Peter and many houses. Citizens were shot and others taken prisoners and compelled to go with the troops. Many of the civilians hid in cellars, but the soldiers fired down through the gratings. On 27 August orders were given that everyone should leave the city; it was going to be bombarded. The exodus began in the morning; streams of men, women and children passed along the roads — in opposite directions — leading to Malines and Tirlemont. Groups of prisoners with tightly-bound hands were led by long ropes. About 1,000 refugees were brought back to Louvain on 28 August and placed in a large building on the cavalry exercise ground. «These prisoners were practically without food from early morning on the 26th until midnight on the 29th. Of the corpses seen on the road some had their hands tied behind their backs, others were burnt, some had been killed by blows, and some corpses were those of children who had been shot. . . . On the way from Rotselaer to Wespelaer 50 bodies were seen, some naked and carbonized and unrecognizable» (Bryce Report). A crowd of men, women and children from Aerschot (q.v.) were marched to Louvain and exposed to rifle and machine-gun fire. One batch of prisoners comprised 27 ecclesiastics, of whom Father Eugene Dupiéreux, aged 23, was executed in the presence of his colleagues for having in his pocket a piece of paper on which was written: «The Germans have invaded Belgium with fire and sword . . . when Omar destroyed the library of Alexandria, none believed that such vandalism would ever be repeated. It was repeated in Louvain . . . such is the Germanische kultur of which they boasted so much.» Father Schill, S. J., a native of Luxemburg, was compelled to read the document — which was in French — and translate it into German. Consult Massart, Jean, 'Belgians under the German Eagle' (London 1916); Morgan, J. H., 'Official Investigation on German Atrocities' (London 1916); 'An Eye-Witness at Louvain' (per Father Thurston, S. J., London 1914); Toynbee, A. J., 'The German Terror in Belgium' (New York 1917). See WAR, EUROPEAN: INVASION OF BELGIUM. Pop. 42,123.

LOUVAIN, University of. An institution for higher education situated at Louvain, Belgium. It was founded in 1425 and was richly endowed. At one time it had 28 constituent colleges, including the Collegium Trilingue, founded in 1517 for the study of Hebrew, Greek and Latin. In the 16th century the university was attended by 6,000 students and was one of the first scientific institutions of Europe, celebrated especially for its department of Roman Catholic theology. The university played an important part in the reformation from within of the Catholic Church in the 16th century. Some of its faculties were transferred to Brussels in 1788, but during the French Revolution the university was suppressed and although it was reconstituted in 1817 it has not regained its past glory. The present foundation dates from 1834–35 when the Belgian bishops re-established the university on its present basis. In 1913 it had 2,855 students and a library of 250 incunabula and 120,000 volumes. In August 1914 the university and library were razed by the German hordes pouring over the border to attack France. All the work of the university was suspended at Louvain, but the leading British universities made generous offer of their facilities to the homeless faculties of Louvain and to such of its students as were able to continue their course. Consult Gill, H. V., ‘Louvain and its University’ (in *Irish Monthly*, Vol. XLII, Dublin 1914).

L'OUVERTURE, Toussaint. See TOUSSAINT L'OUVERTURE.

LOUVOIS, François Michel Le Tellier, frän-swä mē-shĕl lė tĕl-ē-ā loo-vwä, MARQUIS OF, Minister of War to Louis XIV: b. Paris, 18 Jan. 1641; d. 16 July 1691. He was early made a royal councillor through the influence of his father who was War Secretary. After 1666 he had the whole management of the Ministry of War and soon exercised great power under the king and over the army. His extensive knowledge, his decision, activity, industry and talents, rendered him an able minister; but he was too lavish of the blood and treasure of France and he pandered to the vanity and passion for military glory of his master. Justly appreciated, Louvois must be considered as the evil genius of the showy but disastrous reign of Louis XIV. The war of 1672 against Holland was begun at his instigation. The victories of Turenne in 1674 and 1675 were gained by a disobedience of the orders of the Minister of War; but the devastation of the Palatinate was commanded by him. On the death of Colbert (1683), of whom he had been the enemy, his influence became still greater; he opposed Louis' secret marriage with Madame de Maintenon; and to a large extent he was responsible for the revocation of the Edict of Nantes (1685), the *dragonnades,* and the consequent flight of so many peaceful and industrious Calvinists. The encroachments of France had united the European powers in the League of Augsburg. Louvois would have the king commence operations against the allies at once, but the growing influence of Madame de Maintenon was sufficient to prevent this. In 1688 however, the French forces took Philipsburg on the Rhine, and on the order of Louvois the Palatinate was reduced to a wilderness in midwinter (1689). Louvois' scheme of army organization lasted till the empire; but he undid the constructive work of Colbert and destroyed the commerce of France. Consult Rousset, ‘Histoire de Louvois’ (Paris 1872); Michel, ‘Louvois et les protestants’ (ib. 1870).

LOUVRE, loovr, The, an old royal palace at Paris, on the north bank of the Seine, a splendid quadrangular edifice, with a court in the centre, completed by Napoleon. The origin of its name and the time of the erection of the oldest part of it are unknown. It is only known that Philip Augustus, in 1214, built a fort and a state prison in this place, that Charles V, during the years 1364–80, added some embellishments to the building and brought his library and his treasury thither. From the great donjon tower in the centre of the castle the great fiefs of France took the feudal oath. Francis I erected that part of the palace which is now called the old Louvre. Henry IV laid the foundation of the splendid gallery which connects the Louvre on the south side with the Tuileries; Louis XIII erected the centre, and Louis XIV, according to the plan of the physician Perrault, the elegant façade toward the east, together with the colonnade of the Louvre, which is still the most perfect work of architecture in France. At a later period Louis XIV chose the palace built by him at Versailles for his residence. After Napoleon had taken possession of the Tuileries he began a second gallery, opposite to the former, by which the two palaces would have been made to form a great whole, with a large quadrangular court in the centre; only 600 feet of it were completed at the time of his abdication, and it remained uncompleted till 1857, when the work, in an improved and extended form, was finished. It was greatly injured by the communists in May 1871, the Richelieu pavilion, containing the magnificent library, being burned. A great reconstruction was made between 1900 and 1902. The Louvre was set apart by the Convention as a museum for the national collections in science and art and was first called Le Musée National. It contains the museums of paintings, drawings, engravings, bronze antiques, sculptures, ancient and modern, tapestries, furniture, together with special collections of antiquities and an ethnographical collection. The collection of paintings is the largest in the world, French being best represented, and Dutch masters next. There are works by Raphael, Leonardo da Vinci, Titian, Rubens and Van Dyck. Since 1895 the Louvre has been given the right to buy and sell like a private individual, and a society exists for the purpose of helping the museum to buy works of importance. In 1909 the Museum of Decorative Arts was transferred from the Palais de l'Industrie to the Louvre.

LOUŸS, loo'é, **Pierre,** French novelist and poet: b. Paris, 1870. He was educated at the Lycée of Janson de Sailly and at the Sorbonne. In 1889 he founded the review, *La Conque.* He came into prominence in 1896 with the publication of the novel ‘Aphrodite.’ Ten years later it was produced as an opera. The scene is laid in Alexandria at the beginning of the Christian era. Louÿs' ‘Chansons de Bilitis, roman lyrique’ purports to be a Greek translation. Its subject matter is objectionable. Other works are ‘Astarté’ (1892); ‘La femme et le pantin’ (1898); ‘Les aventures du roi Pausole’ (1900); ‘Sanguines’ (1903); ‘L'Archipel’ (1906); ‘Psyché’ (1909), and a translation from Lucan, ‘La vie des courtisanes’ (1894).

LOVAGE, an umbelliferous plant of the genus *Levisticum,* native to the south of Europe, sometimes cultivated in gardens, and notwithstanding its strong and peculiar odor, used as a salad plant. Its roots and seeds are aromatic, acrid and stimulant, and a liquor called “lovage” is made from them. The Scottish lovage is a native of the sea-coasts and has become naturalized in maritime New England. It is eaten, both raw and boiled, by the Shetlanders. The flavor is aromatic, but acrid and very nauseous to those unaccustomed to it.

LOVAT, lŏv'ạt, **Simon Fraser**, 12th Baron, Scottish chieftain: b. 1667; d. London, 9 April 1747. He was educated at King's College, Aberdeen, and in 1699, on the death of his father, assumed the title of Lord Lovat, to which on the death of the 10th Lord Lovat his father had acquired a disputed claim. In consequence of proceedings taken in 1698 against him and his clan, in which he was declared guilty of treason, he went to France. He afterward obtained a pardon and returned to Scotland. Being summoned before the High Court of Justiciary in 1701 for an outrage done to the Dowager Lady Lovat, whom he married by violence, he failed to appear, and was outlawed. In 1715 he was asked by the Jacobites of his clan to espouse the cause of the Pretender, but inducing them to support the government he received in reward the estate and title of Lovat, the other claimant of which had been involved in the rebellion. In 1740 he was the first to sign the association for the support of the Pretender, and on the breaking-out of the rebellion, in 1745, sent his eldest son with a body of his clan to join the Pretender, while he remaining at home asserted his loyalty to the house of Brunswick. It was only after the prince's success at Prestonpans that he allowed his real sympathies to be shown. He was arrested after Culloden, found guilty of treason and was executed on Tower Hill, in the 80th year of his age. Consult Burton, 'Life of Simon, Lord Lovat' (London 1847); and Mackenzie, W. C., 'Simon Fraser, Lord Lovat: His Life and Times' (ib. 1908).

LOVE, Court of. See COURT OF LOVE.

LOVE-APPLE. See TOMATO.

LOVE-BIRD, one of the very small parrots of the genus *Agapornis,* not larger than sparrows, which show extreme affection for one another, two or more sitting as close as possible to one another, and cooing and caressing in a manner most delightful to watch. They are common as cage-birds all over the world, are pretty in color and fond of being petted. They are to be treated and fed in the cage in the same way as canaries. The true love-birds are African, but dealers give the same name to various other diminutive tropical species of similar habits. See PARROTS and the books cited there.

LOVE FEASTS, religious meetings held quarterly by the Wesleyan and other sects. Love feasts are retained in avowed imitation of the ancient Agapæ. See AGAPE.

LOVE LIES A-BLEEDING. See AMARANTHUS.

LOVEDALE, South Africa, an important educational and mission station about 40 miles west of King William's Town and 650 miles northeast of Cape Town. It was founded in 1841 by the Free Church of Scotland (now the United Free Church). Besides a general education, it trains teachers for native schools, and gives technical instruction in printing, bookbinding, telegraphy, carpentering and other useful arts and crafts; its success has been most creditable.

LOVEJOY, Arthur Oncken, American professor: b. Berlin, Germany, 10 Oct. 1873. In 1895 he was graduated at the University of California, and subsequently studied at the universities of Harvard and Paris. In 1899–1901 he was assistant and associate professor of philosophy at Leland Stanford Junior University; from 1901 to 1908 professor of philosophy at Washington University, Saint Louis. In 1908–10 he held a similar chair at the University of Missouri, and since 1910 has been professor of philosophy at Johns Hopkins. In 1907–08 he was lecturer in philosophy at Columbia University. Professor Lovejoy is Fellow of the American Association for the Advancement of Science; was president in 1909 of the Western Philosophical Association, and in 1915 served as secretary of the American Association of University Professors. He is a contributor to the *Journal of Philosophy,* the *Journal of Ethics,* the *Hibbert Journal, Mind,* the *Monist,* the *Nation,* etc.

LOVEJOY, Elijah Parish, American abolitionist: b. Albion, Me., 9 Nov. 1802; d. Alton, Ill., 7 Nov. 1837. He was graduated at Waterville College in 1826, and at the Princeton Theological Seminary in 1833, and was ordained to the ministry, but soon after assumed the editorship of the Saint Louis *Observer,* a Presbyterian paper of considerable influence. His utterances on the slavery question did not begin to appear in the *Observer* until he had been for some time in charge of its columns, and his first references to that subject were marked by moderation. But, stirred by the lynching of a negro murderer by burning, he published an editorial which incensed the pro-slavery part of the community. Hostility was so violent that he removed the paper to Alton, Ill., where a mob threw his press into the river. He was presented with another by Alton friends, and 8 Sept. 1836 published the first issue of the Alton *Observer.* He soon took a bolder anti-slavery stand, and began to call for the organization of a State abolition society. Again, in August 1837, he was mobbed, his office wrecked and the press destroyed, and when a new press was bought the ruin was again repeated. The fourth press was set up in a warehouse under an armed guard; but during the night of 7 Nov. 1837 a score or two of men attacked the building, disregarded Lovejoy's warning, were fired upon and one of the assailants was killed. An attempt was then made to set the warehouse on fire, and when Lovejoy was preparing to shoot the incendiary, he himself received a mortal gunshot wound. The mob then took possession of the place, and once more Lovejoy's press was destroyed. The whole country was excited by these events; public feeling was manifested in various ways; but the most significant effect of the tragedy was a more distinct arraying of forces for the "irrepressible conflict" which had already begun. Consult J. C. and Owen Lovejoy's 'Memoir' (New York 1838); May, 'Some Recollections of Our Anti-slavery Conflict' (Boston 1869); Tanner, Henry (one of the defenders of the warehouse), 'The Martyrdom of Lovejoy' (Chicago 1881); Garrison, 'William Lloyd Garrison' (New York 1885), and Martyn, 'Wendell Phillips — the Agitator' (1890).

LOVEJOY, Owen, American abolitionist: b. Albion, Me., 1811; d. 1864. He was a brother of E. P. Lovejoy (q.v.); was educated at Bowdoin College, and in early life he removed to Alton, Ill. Entering the ministry of the Congregational Church, he preached and lectured against slavery with a power that roused his hearers and carried wide conviction. At Princeton, Ill., where he began a pastorate in 1838, he became conspicuous for the earnestness of his anti-slavery addresses, and for his persistence in holding anti-slavery meetings in defiance of legal and official prohibitions. In 1844 he was elected to the legislature, and resigned his pulpit. Elected to Congress in 1856 he participated in its most exciting debates until the time of his death. He was with his brother Elijah at Alton, Ill., 7 Nov. 1837, and was a witness of his tragic death.

LOVEJOY, Owen Reed, American sociologist: b. Jamestown, Mich., 9 Sept. 1866. In 1891 he was graduated at Albion College, Michigan. From 1891 to 1898 he was minister of the Methodist Episcopal Church and from 1899 to 1904 served as pastor of a Congregational church at Mount Vernon, N. Y. In 1904 he became assistant secretary and three years later general secretary of the National Child Labor Committee. He is a member of the American Association for Labor Legislation, the American Economic Association, the American Political Science Association, the National Conference of Charities and Corrections, the New York Academy of Political Science, etc. He has published bulletins and papers on uniform child-labor laws, child labor in the glass industry, etc.

LOVELACE, Francis, American colonial governor: b. Hurley, Berkshire, England, about 1618; d. England, about 1675. He was a younger son of the 1st Baron Lovelace; was an adherent of the royalist cause during the Puritan uprising and during the Commonwealth. In 1668 succeeded Richard Nicolls as governor of New York. He encouraged trade and the fishery interests and permitted religious freedom, but oppressed the inhabitants by heavy taxation and became very unpopular. During his temporary absence from the town in 1673 the Dutch fleet appeared in the harbor and the citizens speedily surrendered willingly. Lovelace was permitted to return to England, and it is believed that he died there about two years afterward.

LOVELACE, Richard, English lyrical poet: b. Woolwich, Kent, 1618; d. London, 1658. He was educated at Oxford, entered the army and became a captain. He joined the expedition to Scotland in 1639. He spent his fortune in support of the royal cause; was imprisoned in 1642 for petitioning for a restoration of the rights of the king. After entering into the French service, in 1648, he returned to England and was imprisoned until the king's death. His destitute condition at this time is in marked contrast to accounts of his handsome person and splendid appearance earlier in life. He died in great poverty. His poems, which are light and elegant, were published in 1659 under the title of 'Lucasta.' The best known of his lyrics are 'To Althea, from Prison' and 'To Lucasta, on Going to the Wars.' Lovelace, who for spirit and gallantry has been compared to Sir Philip Sidney, also wrote 'The Scholar' (1636), a comedy, and 'The Soldier' (1640), a tragedy. An edition of his poems, edited by W. C. Hazlitt, was published in 1864.

LOVELAND, lŭv'lănd, Colo., city in Larimer County, on the Colorado and Southern and the Great Western railroads, 60 miles north of Denver. The city has a Carnegie library, hospital, the Loveland Cañon, Estes Park, also beet-sugar mills, canning factories, brick-yards, gypsum mills and a co-operative condensing plant. The electric-light plant and the water-supply system are municipally owned. Pop. 3,650.

LOVELL, James, American patriot: b. Boston, Mass., 31 Oct. 1737; d. Windham, Me., 14 July 1814. He was a son of John Lovell (q.v.), was graduated from Harvard in 1756 and taught in the Boston Latin School under his father in 1757–75. In 1771 he delivered the first anniversary oration on the so-called «Boston Massacre.» He was imprisoned by General Gage and carried to Halifax, but was exchanged in November 1776, and sat in the Continental Congress, 1776–82. He was collector of the port of Boston, 1788–89, and its naval officer, 1790–1814. He failed to appreciate Washington's qualities as leader and supported the Conway Cabal to place General Gates in supreme command.

LOVELL, John, American educator: b. Boston, Mass., 16 June 1710; d. Halifax, N. S., 1778. He was graduated from Harvard in 1728. The next year he was appointed usher in the Boston Latin School and was its master from 1734 till the siege of Boston caused its suspension, 19 April 1775. He was a rigid disciplinarian, but nevertheless genial and popular, and many of his pupils were leaders of the Revolution. In 1743 he was the chosen orator at the dedication of Faneuil Hall. A loyalist in his sympathies he went to Halifax on the evacuation of Boston by the English troops and died there. A portrait of him by Smybert is in Memorial Hall at Harvard University.

LOVELL, Mansfield, American soldier: b. Washington, D. C., 1822; d. 1884. In 1842 he was graduated at the United States Military Academy; was commissioned lieutenant of artillery and saw active service against Mexico. He was wounded at Monterey. He resigned from the army in 1854 and entered civil life, becoming in 1858 superintendent of street improvements and deputy street commissioner of New York. On the outbreak of the Civil War he became a major-general in the Confederate army; was attached to the Department of the South with New Orleans as headquarters. He surrendered that city to Farragut. In the later phases of the war he served in Mississippi, Georgia and South Carolina. For some few years after the war he retired to a plantation near Savannah, but subsequently served as assistant to John Newton in deepening the ship channel at Hell Gate in the East River, New York.

LOVEMAN, Robert, American poet: b. Cleveland, Ohio, 11 April 1864. He received an academic education at Dalton, Ga., and thereafter traveled and studied abroad. He has been a frequent contributor to magazines, and his verse is marked by simplicity and earnestness. He has published 'Poems' in 1889, 1893 and 1897; 'A Book of Verse' (1900); 'The Gates of Silence,' with 'Interludes of Song' (1903); 'Songs from a Georgia Garden'; 'Echoes from the Gates of Silence' (1905); 'The Blushful South and Hippocrene' (1909); 'On the Way to Willowdale' (1912).

LOVER, Samuel, Irish painter, novelist and poet: b. Dublin, 24 Feb. 1797; d. Saint Helier, Island of Jersey, 6 July 1868. He first devoted his attention to painting, and in 1828 became a member of the Royal Hibernian Academy of Art. He afterward wrote novels, which he illustrated himself, dramas, operettas and songs which he set to music of his own. In 1844 he gave a series of public entertainments called Irish evenings, which he repeated in the United States and Canada in 1846. Among his works are 'Legends and Stories of Ireland' (1831); 'Rory O'More' (1837); 'Songs and Ballads' (1839); 'Handy Andy' (1842); 'Treasure Trove' (1844). The 'Angels' Whisper'; 'Rory O'More'; 'Molly Bawn' and the 'Low-backed Car' are among his most popular songs. His works in six volumes, with introduction by O'Donohue, were issued in New York in 1900, and with introduction by Roche, in Boston, 1902.

LOVE'S LABOUR'S LOST (circa 1590) is the most obviously experimental of Shakespeare's plays and for that reason is reckoned his earliest unaided work (that it was actually earlier than 'The Comedy of Errors,' which was written under classic guidance, cannot be asserted). It has one of Shakespeare's two or three most original plots and technically one of the worst, though it is distinctly entertaining. The central situation is the converse of that in Tennyson's 'Princess': for the sake of study a company of young gentlemen have bound themselves to absurd regulations against communication with women. Around the inevitable shattering of these self-imposed vows the author puts together a loose succession of scenes quite lacking in coherence, but suggested by all the varied ideas which at the time happened to be in his mind; his recollection from Stratford of the comicality of the country parson, schoolmaster and yokel; his almost naïve admiration of the superficially brilliant London lords and ladies; and his yet far from intelligent interest in foreign affairs. The chief figures are leading personages in contemporary French history: the Princess of France (Queen Catherine de Medici), Henry of Navarre, two Huguenot generals associated with him (Longaville and Biron), and — bizarrely enough — Navarre's arch-enemy, the Duc de Mayenne (Dumaine). These veteran diplomats and warriors are represented as sentimental young people of the most charming wit and volatility. Insouciance is the keynote; the play's the thing; but nothing that happens really matters and the plot leads nowhere. This comedy is primarily interesting as a study in style. Lyly exerts the strongest literary influence and there is much echoing of his mannered prose, as well as of his artificial pictures of social life at court; but rhyming couplets, blank verse, quatrains, anapæstic rhyme, hexameter, doggerel and various lyric measures are all experimentally employed. Naturally enough, greater maturity appears in the lyric than in the dramatic portions. Masefield calls the final song ('When daisies pied and violets blue') "the loveliest thing ever said about England." Unconsciously, but certainly, Shakespeare mirrors himself in his chief figure, Biron, and the comedy is revelatory in the most important degree of the author's mental tendencies at the beginning of his career. An admirable and promising sanity appears in Biron-Shakespeare's final renunciation of the flimsy brilliancies which so enchanted him:

> "Taffeta phrases, silken terms precise,
> Three-pil'd hyperboles, spruce affectation,
> Figures pedantical; these summer-flies
> Have blown me full of maggot ostentation.
> I do forswear them —" (V.ii, 406 ff.)

The play enjoyed a lasting esteem on the Elizabethan stage. There is no question that the text as we have it includes alterations and additions made when Shakespeare's art had further developed — probably when the comedy was revived for performance before Queen Elizabeth herself on Christmas of either 1597 or 1598 (consult Gray, H. D., 'The Original Version of "Love's Labour's Lost,"' etc. Stanford Univ., 1918). Another court performance, before James I, was given by Shakespeare's company at Whitehall early in January 1605.

TUCKER BROOKE.

LOVETT, Edgar Odell, American mathematician: b. Shreve, Ohio, 14 April 1871. In 1890 he was graduated at Bethany College, West Virginia, and later studied at the universities of Virginia, Leipzig and Christiania. In 1890–92 he was professor of mathematics at West Kentucky College; from 1892 to 1895 was instructor in astronomy at the University of Virginia. In 1897 he became instructor in mathematics, in 1898 assistant professor, in 1900 professor at Princeton. In 1905–08 he held the chair of astronomy there. In 1908 Professor Lovett was made president of Rice Institute, Houston, Tex. He is a contributor on geometry, mechanics and mathematical astronomy to various American and foreign journals.

LOVETT, Robert Scott, American railway official: b. San Jacinto, Tex., 22 June 1860. He was educated in the public schools and Houston High School, followed by private instruction. In 1882 he was admitted to the bar; was attorney for the Houston, East and West Texas Railway Company in 1884–89, assistant general attorney of the Texas and Pacific Railway in 1889–91 and general attorney of this road in 1891–92. From 1892 to 1903 Mr. Lovett was general attorney and counsel for all Southern Pacific lines in Texas. From 1904 to 1909 Mr. Lovett was general counsel for the Union Pacific and the Southern Pacific and affiliated railroads, and from 1909 to 1913 he was chairman of the executive committee and president of these systems. In March 1918 he became director of the division of additions and betterments under the United States Railway Administration.

LOW, Albert Peter, Canadian geologist: b. Montreal, 1861. He received his education at McGill University; began his connection with the Canadian Geological Survey in 1881 and was appointed geologist in 1891. From 1892 to 1899 he made extended explorations of the Labrador Peninsula (Ungava). In 1900, at the Paris Exposition Mr. Low had charge of the Canadian mineral exhibit. In 1901–02 he discovered workable iron deposits in Hudson Bay and in 1903 was in charge of an Arctic expedition which claimed the Arctic islands for Canada. In 1906 he was made director of the Canadian Geological Survey and in the following year Deputy Minister of Mines. In 1896 he was awarded the Gill prize by the Royal Geographical Society of England and has served as vice-president of the Geological Society of America and of the Canada Forestry Association.

LOW, A(lfred) Maurice, Anglo-American author and journalist; b. London, England, 1860. He was educated at King's College, London, and in Austria. He has been chief American correspondent of the London *Morning Post* and writer on American affairs for the London *National Review* since 1896. He investigated certain phases of English labor legislation for the United States Department of Labor in 1900, and English trade unions and industry in 1903. He has written 'The Supreme Surrender' (1901); 'Protection in the United States' (1904); 'American Life in Town and Country' (1905); 'A Short History of Labor Legislation in Great Britain' (1907); 'The American People: A Study in National Psychology' (2 vols., 1909–11), and contributions to leading English and Americans reviews.

LOW, Charles Rathbone, English historian and naval officer: b. Dublin, Ireland, 30 Oct. 1837. He went to sea in 1853, has served in Asiatic and African waters and holds the rank of commander in the Indian navy. He is the author of numerous works, including 'Tales of Old Ocean' (1860); 'Land of the Sun' (1870); 'History of the British Navy' (1872); 'History of the Indian Navy' (1877); 'History of Maritime Discovery' (1899); 'Her Majesty's Navy' (1902); 'Britannia's Bulwarks' (1895); 'The Epic of Olympas' (1897), etc.

LOW, Mary Fairchild, American artist: b. New Haven, Conn., 1866. She studied in the School of Fine Arts, Saint Louis, the Academie Julien, Paris, and with Carolus-Duran. In 1888 she married Frederick MacMonnies, the sculptor, and in 1909 Will Hicok Low, the figure and genre painter. She was awarded a medal at the Chicago Exposition of 1893, a bronze medal at Paris, in 1900, bronze medal at the Buffalo Exposition 1901, gold medal at Dresden 1902, the Julia M. Shaw memorial prize of the Society of American Artists, New York 1902, and a gold medal at Rouen in 1903; her picture was bought by the city of Rouen and placed in the Museum of Fine Arts. In 1905 she was awarded a gold medal at Marseilles and a gold medal at Rouen in 1911. Mrs. Low is an associate National Academician. Her works include 'Early Morning Flower Market'; 'Little Women;' 'Christmas Eve'; 'Portrait of Will Hicok Low'; 'Dogwood in Bloom,' etc.

LOW, Sampson, English publisher: b. London, 1797; d. 1886. He became manager in 1837 of a fortnightly trade journal styled *The Publishers' Circular,* on which his 'British Catalogue' was afterward based and of which he became proprietor in 1867. He established the publishing house of Sampson Low & Co., in 1848. His various compilations include 'Index to Current Literature' (1859–60); 'Low's Literary Almanac' (1873), etc.

LOW, Seth, American educator and administrator; b. Brooklyn, N. Y., 18 Jan. 1850; d. Bedford Hills, N. Y., 17 Sept. 1916. He was educated at the Brooklyn Polytechnic Institute and at Columbia, graduating from the latter in 1870. He then entered his father's tea and silk importing business as a clerk, and passing through all the intermediate grades became a junior partner in the firm in 1875. In 1879 he and the other junior partners took full control of the business which was finally liquidated in 1888. He was early interested in public affairs, especially in charities, was prominent in the movement which resulted in abolishing the system of outdoor relief of Kings County, and was organizer and first president of the Bureau of Charities. He was also active in the Republican party, being president of the Young Republican Club in the Garfield campaign of 1880; and though he resigned the presidency remained an active member of this club, which soon began agitation for the non-partisan administration of city affairs. In 1881 he was nominated for mayor of Brooklyn on an independent ticket, and elected: after an efficient administration he was re-elected in 1883, serving another two years. His administrations were marked by reforms in the system of taxation, and in the public schools, but more especially by the introduction of the civil service system and non-partisan appointments in city affairs. In October 1889 he was offered the presidency of Columbia College (now Columbia University), which he accepted. While he was president, the undergraduate department was enlarged, the graduate schools and Barnard closely affiliated, the institution organized as a university and the site changed. He also gave the university $1,000,000 for the erection of a library building. He retained his interest in public affairs, was a member of the Rapid Transit Commission, and of the Greater New York Charter Commission, and an earnest advocate of consolidation; he was also twice a referee in labor troubles. In 1897 he was an independent candidate for mayor of Greater New York and was defeated, though polling over 150,000 votes. In 1899 he was a member of the United States delegation to The Hague Peace Conference. In 1901 he was nominated for mayor of Greater New York on a Fusion ticket, and was elected. His administration of the next two years led to a reduction of the taxes, sweeping reforms in the police department and an enlargement of the public school system, and showed a strict adherence to the principles of business-like administration of public affairs which characterized his Brooklyn mayoralty. In 1903 he was again Fusion candidate for mayor, but was defeated, a defeat generally attributed not to any serious mistakes or faults in his administration, but rather to party questions and complications. From 1907 until his death he was president of The National Civic Federation. In 1914 he was elected president of the Chamber of Commerce of the State of New York, which office he held until his death. In 1914 he was appointed by President Woodrow Wilson chairman of The President's Colorado Coal Commission. In connection with this appointment the great coal strike in Colorado was called off. He was delegate-at-large and chairman of the Cities Committee of the New York State Constitutional Convention, 1915.

LOW, Will Hicok, American painter: b. Albany, N. Y., 31 May 1853. He learned painting at Paris under Gérôme and Carolus-Duran (1873–77), and since 1890 has been Academician of the National Academy of Design, and is one of the founders of the Society of American Artists. He is classed among the most active and versatile of living American artists and has been alike successful in decorative wall paintings, stained glass (at which he worked with John La Farge, q.v.), portrait and book illustration in black and white. His strength as a designer and colorist has been recognized by the public awards made to his work and by the demand for his services on the part of private and public patrons and connoisseurs. He has also had charge of life classes in the schools of Cooper Union and the National Academy of Design. He delivered the Scammon lectures at the Chicago Art Institute in 1910. These were published later under the title, 'A Painters' Progress' (1910). The following are some of his best-known pictures: 'Portrait of Albani' (1877); 'Chloe' (1882); 'My Lady' (Lotus Club, New York); 'Aurora' (1894), Metropolitan Museum, New York; 'Homage to Venus' (mural painting, Waldorf-Astoria, New York); 'The Orange Vendor,' in the Art Institute, Chicago; 'Christmas Morning,' in Washington National Gallery. There are 10 stained-glass windows by him in Saint Paul's Methodist Episcopal Church, Newark, N. J.; and mural paintings in Saint Paul's Church, Albany, N. Y., and the Federal Building, Cleveland, Ohio. He also installed a frieze in the Legislative Library at the New York State Capitol, and completed 20 mural paintings for the rotunda of the New York State Education Building, Albany, N. Y. He has published 'A Chronicle of Friendships' (1908); and has contributed on art to the *Century, Scribner's, McClure's,* etc.

LOW CHURCH, a popular name given to a section of the Church of England whose opinions are opposed to those of the High Church party, and are especially hostile to ritualism and sacerdotalism.

LOW COUNTRIES. See Belgium and Holland.

LOW POTENTIAL SYSTEM. See Electrical Terms.

LOW SUNDAY, the first Sunday after Easter, so called to emphasize the contrast between the great feast of the Resurrection and the Sunday which ends the octave. In the Missal (q.v.) and the Breviary (q.v.) the name is «Dominica in Albis,» because on this day the newly baptized wore their white robes for the last time. Mention is made of this custom in the Breviary hymn used in the vespers of Low Sunday, «Ad regias Agni dapes.» The name «Beloken Paschen,» close of Easter, is used frequently in Holland; and «Quasimodo,» the first word in the Introit of the Mass for the day, is the common name for this day in Germany and France.

LOWDEN, Frank Orren, American public official: b. Sunrise City, Minn., 26 Jan. 1861. In 1885 he was graduated at the State University of Iowa, and two years later received the degree of LL.B at the Union College of Law, Chicago. From 1887 to 1902 Mr. Lowden practised his profession in Chicago and in 1889 held the chair of law at Northwestern University. In 1906 Mr. Lowden was elected member of the 59th Congress for the unexpired term of R. R. Hitt, deceased. He was re-elected to the 60th and 61st Congresses (1907–11), and in 1916 was elected governor of Illionis for the term 1917–21.

LOWE, Charles, English journalist and biographer: b. Balconnel, Forfarshire, Scotland. He was educated at the University of Edinburgh and on the Continent, and was for 13 years *Times* correspondent at Berlin, returning to England in 1891. He published two biographies of Bismarck; 'Bismarck's Table Talk'; 'Alexander III of Russia'; 'King Edward VII'; 'Our Greatest Soldiers,' etc.

LOWE, Sir Hudson, British general: b. Galway, 28 July 1769; d. London, 10 Jan. 1844. He entered the army at an early age and saw much service in Europe; in 1813 was attached to the army of Blücher, and took part in the invasion of France in the early part of the following year. Appointed in 1815 to the command of the English troops which were to co-operate with the Austro-Sardinian army in Italy. He was the first to bring to England news of Napoleon's abdication, in 1814, and was created K.C.B. in 1816. On the fall of Napoleon he was appointed governor of Saint Helena, and entrusted with the care of the ex-emperor. He returned to England in July 1821, and was afterward on the staff in Ceylon, 1825–30. He has been accused by the partisans of Napoleon for want of courtesy and for rigor and cruelty to his prisoner. It is, however, freely admitted that Napoleon and his suite made a system of exaggerating their grievances, and even sedulously tried to provoke them, with a view to exciting sympathy in Europe and especially in England. Many of the grievances were puerile, as that Sir Hudson would not give Napoleon the title of emperor, which England had never recognized, and which he was forbidden by his government to use. Consult Forsyth, 'Captivity of Napoleon at Saint Helena from Letters and Journals of Sir Hudson Lowe' (London 1853); O'Meara, 'A Voice from Saint Helena: Napoleon in Exile' (the work of the deposed emperor's physician: ib., 1822); Rose, J. H., 'Napoleonic Studies' (ib. 1904); Lord Rosebery, 'Napoleon: the Last Phase'; Seaton, 'Sir Hudson Lowe and Napoleon' (ib. 1898).

LOWE, John, American rear-admiral: b. Liverpool, England, 11 Dec. 1838. He was educated in his native city and Columbus, Ohio, and entered the American navy in 1861. He served through the Civil War and accompanied the Greely Relief Expedition in 1884. He was the first naval officer of any nation to serve in a submarine torpedo-boat. This he did in 1898. He made the first report ever presented to the Secretary of the Navy upon that topic. He was promoted rear-admiral 11 Dec. 1900, and retired the same day.

LOWE, Robert, VISCOUNT SHERBROOKE, English politician: b. Bingham, Nottinghamshire, 4 Dec. 1811; d. London, 27 July 1892. He was educated at Winchester College and at University College, Oxford, and directly upon his admission to the bar in 1842 went to Australia, where he quickly attained prominence in political affairs. In 1843 he became a member of the Legislative Council of New South Wales, and made himself famous by his opposition to the land monopoly, as well as by the part he performed in the development of education and the regulation of finance. He also made effectual protest against the English practice of transporting convicts to Australia. Meanwhile he was not neglectful of his private affairs, but acquired great wealth, and returned to England in 1850 and became a leader writer on the *Times.* He sat for Kidderminster, 1852–58; Calne, 1859–67; and London University, 1868–80. He was vice-president of the Board of Control 1852–55, and vice-president of the Board of Trade 1855–58; joint secretary of the Board of Control, and in 1859, under Palmerston, was placed practically at the head of educational affairs. In consequence of a mistaken vote of censure by the House of Commons in 1864 he resigned his office, but only to participate with ability more marked than before in the proceedings of that body. The rejection of the Whig Reform Bill in 1866 was considered to have been largely due to his brilliant and powerful speeches against it. As one of the Adullamites (q.v.) he received overtures from the government of Lord Derby, but although he called himself an outcast from the Liberal party he refused to leave it. In 1867 he made a number of speeches designed to justify his opposition to extension of the suffrage. His strong support of the resolutions for disestablishment of the Irish Church, in 1868, restored him to favor in the Liberal party; and in December of that year he became Chancellor of the Exchequer under Gladstone, giving up that office in 1873 to accept the post of Home Secretary, in which, however, his tenure was brief. His reforms as Chancellor of the Exchequer related especially to reduction of sugar duties, the replacing of assessed taxes by license duties and like readjustments. After the fall of the Gladstone ministry in 1874 Lowe took comparatively little part in public affairs. He was raised to the peerage as Viscount Sherbrooke in 1880. Consult Parkes, ‘Fifty Years of Australian History’ (1892); Martin, ‘Life of Lord Sherbrooke’ (1893); Hogan, ‘Robert Lowe, Viscount Sherbrooke’ (1893); also Hansard, ‘Parliamentary Debates.’

LOWE, Thaddeus S. C., American inventor and scientist: b. Jefferson, N. H., 20 Aug. 1832; d. 1913. He constructed balloons in 1856 and 1858–59 in order to study atmospheric phenomena, and during the Civil War was chief of the aeronautic corps. He devised a system of signaling in 1862, and valuable instruments for atmospheric investigation, etc., constructed and operated in 1858 the largest aerostat ever built up to that time, invented a compression ice machine and made the first artificial ice in the United States (1865); and established the Lowe Observatory in the Sierra Madre Mountains, Cal. Other inventions by him were metallurgical furnaces for gas and oil fuel 1869–72, and the water-gas apparatus 1873–75. After 1897 he put into operation the Lowe coke-oven system.

LOWELL, lō'ĕl, **Abbott Lawrence,** American educator and author: b. Boston, 13 Dec. 1856. He was graduated from Harvard in 1877, from the law school of the university in 1880, was a legal practitioner in Boston in 1880–97, and from 1897 to 1899 was a lecturer at Harvard. In 1900 he was appointed there to the chair of the science of government, and in 1909 he became president of Harvard University. He has thoroughly reorganized the financial affairs of the university. He is a trustee of the Lowell Institute since 1900, and of the Carnegie Foundation of the Advancement of Teaching, is a member of the American Academy of Arts and Letters, of the British Academy and honorary member of the Royal Irish Academy. He has received academic honors from the leading American and foreign universities.

Among his works are ‘Transfer of Stock in Corporations,’ with Francis C. Lowell (1884); ‘Essays on Government’ (1889); ‘Governments and Parties in Continental Europe’ (1896); ‘Colonial Civil Service,’ with H. Morse Stephens (1900); ‘Influence of Party in England and America’ (1902); ‘The Government of England’ (1908); ‘Public Opinion and Popular Government’ (1914).

LOWELL, Charles, American clergyman: b. Boston, 15 Aug. 1782; d. Cambridge, 20 Jan. 1861. He was a son of John Lowell (1743–1802). He was graduated from Harvard in 1800, studied theology at Edinburgh, Scotland, and from 1 Jan. 1806 until his death was pastor of the West (Unitarian) Church of Boston. His ill-health caused his absence in Europe and the East (1837–40), and in his later years his place in the pulpit was largely taken by his colleague, Cyrus A. Bartol (q.v.). He was an able orator and of strong anti-slavery views. A founder and member of the Society of Northern Antiquarians of Copenhagen, he was also secretary of the Massachusetts Historical Society and a corresponding member of the Archæological Society of Athens. He was the father of James Russell Lowell and Robert Traill Spence Lowell. Among his published writings are ‘Meditations for the Afflicted, Sick and Dying’; ‘Devotional Exercises for Communicants’; ‘Occasional Sermons’; ‘Practical Sermons’ (1855).

LOWELL, Charles Russell, American soldier: b. Boston, 2 Jan. 1835; d. near Middletown, Va., 20 Oct. 1864. He was graduated from Harvard in 1854, at the beginning of the Civil War was manager of the Mount Savage ironworks, Maryland, on 20 April 1861 was made a captain in the 6th United States Cavalry, and during the Peninsular campaign, at the close of which he received the brevet of major, commanded a squadron of that regiment. Having been assigned to the personal staff of General McClellan, he distinguished himself at Antietam. In November 1862, he organized the 2d Massachusetts Cavalry, of which he became colonel on 10 May 1863. In the winter of 1863–64 he commanded the advanced defenses of Washington, and subsequently he was in command of the provisional cavalry brigade under Sheridan in the Shenandoah, and, ultimately, of the reserve brigade, consisting of three regiments of United States cavalry, the 2d Massachusetts and a battery of artillery. With this force he fought at Opequan Creek (Winchester) (19 Sept. 1864), and defeated General Rosser's cavalry (9 October). In the battle of Cedar Creek (19 October), he successfully resisted the Confederate attack until the arrival of Sheridan, but later in the action, while leading the final charge, was mortally wounded.

LOWELL, Edward Jackson, American author: b. Boston, 18 Oct. 1845; d. Cotuit, Mass., 11 May 1894. He was the grandson of Francis Cabot Lowell (1775–1817) (q.v.). He was graduated from Harvard in 1867, was admitted to the Suffolk County bar in June 1872, for a time practised law in Boston, but subsequently devoted himself exclusively to literary work. He was a member of the Massachusetts Historical Society and a fellow of the American Academy of Arts and Sciences. Among his writings are ‹The Hessians and the other German Auxiliaries of Great Britain in the Revolutionary War› (1884), recognized as standard; ‹The Eve of the French Revolution› (1892); and the section on ‹The Diplomacy and Finance of the Revolution› in Winsor's ‹Narrative and Critical History of America› (1884–89), and numerous magazine and review articles.

LOWELL, Francis Cabot, American manufacturer: b. Newburyport, Mass., 7 April 1775; d. Boston, 10 Aug. 1817. He was graduated at Harvard in 1793 and entered on a mercantile career in Boston. During a visit to England he was seized with the idea of introducing and successfully carrying out the manufacture of cotton in America. In 1812 he began his attempts to manufacture cotton cloth, an undertaking then rendered the more difficult by the fact that the war in progress with Great Britain prevented the importation of English machinery. He finally succeeded, by the aid of Paul Moody, a mechanic of Newburyport, in making a suitable loom, and with P. T. Jackson, his brother-in-law, obtained a charter as the Boston Manufacturing Company, with $100,000 capital, and established at Waltham what is believed to have been the first mill in the United States to combine in one establishment the several operations necessary in manufacturing finished cloth from the raw cotton. He was active in introducing into the tariff act of 1816 the clause imposing a minimum duty on imported cotton fabrics. Jackson, subsequent to Lowell's death, bought a portion of Chelmsford and there located mills; and in 1826 the town was incorporated as Lowell.

LOWELL, Guy, American architect: b. Boston, 6 Aug. 1870. In 1892 he was graduated at Harvard University and in 1894 at the Massachusetts Institute of Technology and in 1899 at the École des Beaux-Arts, Paris. He began practice in Boston in 1900, was architect of the Boston Museum of Fine Arts, the Cumberland County Courthouse, Portland, Me., and the New Hampshire Historical Society Building at Concord, N. H., and numerous educational, commercial and residential buildings. From 1900 to 1913 he was lecturer on landscape architecture at the Massachusetts Institute of Technology. In 1912 Mr. Lowell visited Rome and made careful studies of the architectural remains there, especially of the Coliseum. In the following year he submitted plans for the courthouse in New York City which were an adaptation of the Coliseum to modern business requirements. The plans were accepted, but construction has been delayed due to the very unsatisfactory state of the city finances during the so-called reform administration of Mitchel and the restrictions on building operations while the country was energetically prosecuting the war.

LOWELL, James Russell, American poet, critic and diplomat: b. Cambridge, Mass., 22 Feb. 1819; d. there, 12 Aug. 1891. The Lowells were descended from Percival Lowell of Bristol, England, who emigrated to Massachusetts in 1639. Judge John Lowell, grandfather of the poet, contributed a clause to the Bill of Rights which effected the abolition of slavery in the State. One of the poet's uncles, Francis Cabot Lowell, was a leading promoter of manufactures in New England, and is remembered in the name of the city of Lowell. Another uncle, John Lowell, founded the Lowell Institute of Boston. Rev. Charles Lowell, the poet's father, b. 1782, was graduated at Harvard in 1800, and after some study at the University of Edinburgh was settled over the West Church of Boston, and remained its pastor till his death in 1861. He married Harriet Spence, from a family of Spences in Portsmouth, N. H., who were of Scotch origin. She was the sister of Robert Traill Spence, of naval fame, and is remembered as having the gifts of «a great memory, an extraordinary aptitude for language, and a passionate fondness for ancient songs and ballads,» as also a lively sense of humor. There were five children, two daughters and three sons, of whom James Russell was the youngest. He was prepared for college by William Wells, an English schoolmaster, who gave him an excellent drill in the rudiments of Latin. But perhaps the best part of his early education was derived from the unrestricted use of books at home. His father had come into possession of the old Tory mansion, on the Watertown road, later called Elmwood, and its abundant library was well stocked with attractive authors. He entered Harvard College in his 16th year, graduating in the class of 1838. He was not diligent in the prescribed work of the course, but engaged mainly in desultory reading and in writing essays and verse for college societies and magazines. Because of cleverness thus shown, he was made class poet. But the poem, his first considered effort, was not delivered, as the author had been ordered to Concord, for a brief rustication, on account of some neglect of college rules. It was published the next year, under the title of ‹A Poem Recited at Cambridge.› Lowell now entered the Harvard School of Law, took its degree in 1840 and attempted practice. But he was quickly drawn aside to literature, largely through the influence of Maria White, a young lady of Watertown, to whom he became engaged in the latter part of the same year. The poetic gifts and moral enthusiasm of this young woman quickened Lowell's nature, and gave his bent a purpose. In 1841 he collected some of his best poems

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into a volume called ‘A Year's Life,’ and inscribed it in covert language to his betrothed. Two years later he began, with Robert Carter, the publication of a literary monthly, called *The Pioneer*, with Hawthorne, Poe and Whittier among the contributors, but after three issues it was discontinued. In 1844 occurred his marriage with Maria White; and during the year were published an enlarged edition of the Poems, including ‘A Legend of Brittany,’ ‘Prometheus,’ ‘Miscellaneous Poems,’ and ‘Sonnets,’ and a volume called ‘Conversations on some of the Old Poets.’ In 1848 he again published an edition of the Poems, with the addition of the Third Series, including several poems against slavery. Later in the year ‘The Vision of Sir Launfal,’ ‘A Fable for Critics’ and ‘The Biglow Papers’ came out, the last-named being a reprint of dialect poems furnished to the newspapers of the day. In nothing had Lowell been so effective as in these satires; nothing in the literature of those stirring times attracted more attention. In 1851 he sailed for Europe, with his wife, who was in failing health, and spent a year, mainly in Italy, in study and travel. After their return Mrs. Lowell's health did not improve, and in 1853 she died. A volume of her poems was printed, after her death, for private circulation. In 1855, on the resignation of Professor Longfellow, Lowell was elected Smith professor of the French and Spanish languages, and professor of *belles-lettres* in Harvard College. He spent two years in Europe, to prepare himself more fully, and in 1857 took up the duties of his chair. He married Miss Frances Dunlap, of Portland, Me., the same year. For the next 20 years his strength was taxed incessantly, being devoted, outside of his service in his college, to editorial and critical rather than poetic writing. He was the first editor of *The Atlantic Monthly,* and continued in the position for two years. He had an editorial connection with the *North American Review* from 1862 to 1873, and contributed to it many critical essays of unusual merit. In 1864 he reprinted, in ‘Fireside Travels,’ a few papers of less substantial worth. In the lighter work of this busy period falls the ‘Biglow Papers,’ Second Series, which he began in 1862. These were reissued in 1867. In the next year appeared ‘Under the Willows,’ a collection of his poems written since 1848. In 1869 he published ‘The Cathedral,’ over which he had long worked, and in 1870 ‘Among my Books,’ a reprint of some of his best essays on literary themes. In 1871 followed ‘My Study Windows,’ of like contents, and in 1876 ‘Among my Books,’ Second Series. In 1877 Lowell was called to take the post of Ambassador to Spain, and after three years at Madrid was transferred to the court of Saint James. Here he won the admiration not only of his countrymen, but also of the more exacting English public, by his executive abilities and his social and oratoric gifts. He received public honors from Oxford, Cambridge, Edinburgh and Bologna, and in 1883 was chosen lord rector by the University of Saint Andrews. His residence at Saint James terminated in 1885, and the affliction of his wife's death came to him, the same year, before return. He resumed to some degree his literary labors, after coming back to Cambridge. He published ‘Democracy, and other Addresses’ in 1887, and ‘Heart's-ease and Rue,’ and ‘Political Essays,’ in 1888. He prepared the public address for the celebration of the 250th anniversary of the founding of Harvard University, in November 1886, and delivered a course of lectures on the Old English dramatists before the Lowell Institute in the spring of the following year. In the year before his death he revised and edited a definitive edition of his writings in 10 volumes. Supplemental to these, ‘American Ideas for English Readers,’ ‘Latest Literary Essays and Addresses,’ and ‘Old English Dramatists,’ were issued posthumously in 1892. Lowell was first and chiefly a man of books, yet essentially without bookishness or pedantry. The most scholarly of all the group then making a name in literature, he was incapable of rigid application or of learning for learning's sake. He confessed himself half mystic, half humorist, and could shift from the one to the other vein in a single paragraph. Inheriting traits and principles from the Puritan age, he failed of its discipline and conscious dignity. Because of his untactful and uncompromising attitude upon questions of the day, as slavery and civil service reform, he came to be regarded as an academic thinker and the typical «scholar in politics.» But he materially helped win respect for his class from the public of a later generation, which has elevated a college professor to the presidency of the country. As ambassador at the court of Saint James and at Madrid, he proved himself less a classroom doctrinaire than a man of the world, an esteemed social figure and a facile speaker. Yet he had been thought of at home as too nearly what the Englishman looks for in the typical American. He never lost the point of view of life, never lost sympathy with people, and was perhaps as wise in affairs as in the field of letters and æsthetic criticism. This concord of opposite qualities is conspicuous in the ‘Biglow Papers,’ his most brilliant and least considered performance, which has carried most influence and bids fair to be longest remembered of all his works. As a writer of prose he was often distinguished, yet often wilfully whimsical or sensational,—he could speak of a landscape as «gagged» with snow. His essays show more reading — which was wide except in its literature of northern Europe — than originality, though he was gifted with deeper insight than any other of the New England school save Emerson. As a critic he sometimes lost his sense of perspective, as in his estimate of Mrs. Browning's ‘Aurora Leigh.’ In his chosen field of poetry, Lowell's work is uneven, often savoring of bookishness and formality in his lyric pieces, as ‘To a Dandelion’ and ‘Beaver Brook.’ While at times informal and unnoble in his higher strains, yet here and there at his best, as in ‘Prometheus’ and ‘The Cathedral’ he has left «immortal phrases» which no other American poet can parallel. An elaborate international centennial commemoration of his birthday was celebrated in New York City 19–22 Feb. 1919. See BIGLOW PAPERS; COMMEMORATION ODE.

Bibliography.— Lowell's works were issued in a complete edition (Riverside edition, 11 vols., Boston 1899). His letters were edited in two volumes by Charles Eliot Norton (New York 1894). Consult Brownell, W. C., ‘Amer-

ican Prose Masters' (New York 1909); Cooke, G. W. (compiler), 'Bibliography of James Russell Lowell' (Boston 1906); Greenslet, Ferris, 'James Russell Lowell: His Life and Work' (ib. 1905); Hale, E. E., 'James Russell Lowell and His Friends' (ib. 1899); Howells, W. D., 'Literary Friends' (New York 1900); Hudson, W. H., 'Lowell and His Poetry' (ib. 1912); James, Henry, 'Essays in London and Elsewhere' (ib. 1893); Livingston, L. S. (compiler), 'Bibliography of the First Editions in Book Form of the Writings of James Russell Lowell' (ib. 1914); Pollok, Gustav, 'International Perspective in Criticism' (ib. 1914); Reilly, J. J., 'Lowell as a Critic' (ib. 1915); Richardson, C. F., 'American Literature, 1607–1885' (ib. 1893–94); Scudder, H. E., 'James Russell Lowell' (2 vols., Boston 1901); Stedman, E. C., 'The Poets of America' (11th ed., Boston 1892); Underwood, F. H., 'The Poet and the Man: Recollections of James Russell Lowell' (ib. 1893); Wendell, Barrett, 'Literary History of America' (4th ed., New York 1907).

L. A. Sherman,
Of the University of Nebraska.

LOWELL, John, American jurist: b. Newburyport, Mass., 17 June 1743; d. Roxbury, Mass., 6 May 1802. He was graduated from Harvard in 1760, studied law, entered practice at Newburyport in 1762, represented that town in the general court in 1777 and Boston in 1779, and was a delegate to the convention of 1780 which framed the constitution of Massachusetts. He obtained the insertion in this document of the clause of the preamble which declares that "all men are born free and equal," with the belief that slavery would thus be abolished in Massachusetts. The Supreme Court of the State upheld his contention in 1783, and thereby slavery in the State was abolished at his initiative. In 1782–83 he was a delegate in the Continental Congress, and in 1782 was appointed by the Congress one of three judges of a Court of Appeals to hear appeals from courts of admiralty. In 1784 he was a member of the New York-Massachusetts Boundary Commission. He was made by Washington in 1789 judge of the United States District Court of Massachusetts, and by Adams in 1801 chief justice of the First Circuit of the United States Circuit Court. He was a founder of the American Academy of Arts and Sciences (1780), and one of its councillors. He published an oration on James Bowdoin the elder in Vol. II of the 'Memoirs' of the American Academy; and a poem in 'Pietas et Gratulatio' (1761).

LOWELL, John, American publicist: b. Newburyport, Mass., 6 Oct. 1769; d. Roxbury, Mass., 12 March 1840. He was a son of John Lowell (1743–1802) (q.v.). He was graduated from Harvard in 1786, studied law, was admitted to the bar in 1789, retired from practice in 1803 and after travel in the East (1803–06) devoted his attention to literature. He wrote on agriculture and theology, but chiefly on politics. In various publications he attacked the War of 1812; and by his pen made himself a valuable aid of the Federalists. His interest in horticulture obtained for him the sobriquet of "the Columella of the New England States" and he was the first in the United States to build extensive greenhouses on a scientific plan. For many years he was president of the Massachusetts Agricultural Society. Among his pamphlets were 'Peace Without Dishonor, War Without Hope' (1807); 'Diplomatic Policy of Mr. Madison Unveiled' (1810); 'Candid Comparison of the Washington and Jefferson Administration' (1810), and 'Mr. Madison's War' (1812).

LOWELL, John, American merchant and philanthropist: b. Boston, Mass., 11 May 1799; d. Bombay, India, 4 March 1836. He was the son of F. C. Lowell (1775–1817) (q.v.). He studied at Harvard (1813–15), became a successful merchant in Boston, was several times elected to the Boston common council and the State legislature of Massachusetts and collected a large and valuable library. After 1830 he passed a large part of his time in travel in foreign lands. By the gift of about $250,000,— then the largest ever made in America by an individual for the endowment of a literary institution, with the exception of Girard's bequest for Girard College — he established in Boston the Lowell Institute, to consist of regular annual courses of free public lectures. The institute was opened in the winter of 1839–40, and has proved exceedingly successful. Consult Everett, 'Memoir of John Lowell, Jr.' (1840), and Smith, 'History of the Lowell Institute' (1898).

LOWELL, Josephine Shaw, American philanthropist: b. West Roxbury, Mass., 16 Dec. 1843; d. New York City, 12 Oct. 1905. She was educated in Boston, New York and in Europe, and during the Civil War she was connected with the work of the Sanitary Commission, and subsequently with labors among the freedmen and with other causes of philanthropy and reform. In 1863 she married Col. Charles Russell Lowell, who was killed at Cedar Creek, Va., 1864. She was a founder of the Charity Organization Society of New York in 1881, in 1886–89 was commissioner of the State Board of Charities of New York, and in 1899 was appointed to the board of managers of the New York State reformatory for women. Among her writings are 'Public Relief and Private Charity' (1884); 'Industrial Arbitration and Conciliation' (1893). Consult Stewart, W. R., 'Philanthropic Work of Josephine Shaw Lowell' (New York 1911).

LOWELL, Maria White, American poet: b. Watertown, Mass., 8 July 1821; d. Cambridge, Mass., 27 Oct. 1853. She was the first wife of James Russell Lowell, whom she married in 1844. The best known of her poems are 'The Alpine Shepherd' and 'The Morning Glory,' which appeared in the collection printed privately at Cambridge in 1855. The death of Mrs. Lowell, occurring the same night that a child was born to Mr. Longfellow, called forth the latter's poem beginning:

> "Two angels, one of life and one of death,
> Passed o'er our village as the morning broke."

Mrs. Lowell is known for her influence on her husband in the cause of abolition and for her own writings against slavery.

LOWELL, Percival, American astronomer: b. Boston, 13 March 1855; d. Flagstaff, Ariz., 13 Nov. 1916. He was a brother of Abbott Lawrence Lowell, and was graduated at Harvard in 1876. He went to Japan in 1883 and lived there and in Korea from time to time till 1893. He was counsellor and foreign secretary to Korean Special Mission to the United States in 1894. In 1894 he established the Lowell Observatory; undertook an eclipse expedition to Tripoli in 1900 and in 1907 sent an expedition to photograph the planet Mars. He received the Janssen medal of French Astronomical Society in 1904 for his researches on Mars. In 1908 he received a gold medal from La Sociedad Astronomica de Mexico. He made various discoveries on the planets Mercury, Venus, Saturn and especially Mars. In 1902 he was appointed non-resident professor of astronomy at the Massachusetts Institute of Technology. He was a Fellow of the American Academy of Arts and Sciences, and many other societies in America and Europe. He published ‘Chosön’ (1885); ‘The Soul of the Far East’ (1886); ‘Noto’ (1891); ‘Occult Japan’ (1894); ‘Mars’ (1895); ‘Annals of the Lowell Observatory’ (Vol. I, 1898; Vol. II, 1900; Vol. III, 1905); ‘The Solar System’ (1903); ‘Mars and Its Canals’ (1906); ‘Mars as the Abode of Life’ (1908); ‘The Evolution of Worlds’ (1909) and various papers to learned societies.

LOWELL, Robert Traill Spence, American Episcopal clergyman; b. Boston, 8 Oct. 1816; d. Schenectady, N. Y., 12 Sept. 1891. He was a son of Charles Lowell (q.v.) and a brother of James Russell Lowell (q.v.). He was graduated from Harvard in 1833, for a time studied medicine in the Harvard Medical School, and later was in mercantile life at Boston. In 1839 he began the study of theology; went to Hamilton, Bermuda; was there ordained deacon in 1842 and priest in 1843; and became inspector of schools for the colony and domestic chaplain to the bishop. In 1843–47 he was rector at Bay Roberts, Newfoundland, and during the famine of 1846 in that district rendered valuable service as chairman of the relief committee. Having returned to the United States in 1847, he was active in mission work among the poorer classes at Newark, N. J.; was rector of Christ Church, Duanesburg, N. Y., in 1859–69, head-master of Saint Mark's School (Southboro, Mass.) in 1869–73, and professor of Latin language and literature in Union College in 1873–79. He published ‘The New Priest in Conception Bay’ (1858; revised in 1889), in which Bay Roberts appears as «Peterport»; ‘Fresh Hearts That Failed Three Thousand Years Ago, and other Poems’ (1860); ‘Anthony Brode’ (1874); ‘Burgoyne's March’ (1877), written for the Saratoga County celebration at Bemis Heights, and ‘A Story or Two from an Old Dutch Town’ (1878).

LOWELL, Mass., city, county-seat of Middlesex County, at the junction of the Concord and Merrimac rivers, and on the New York, New Haven and Hartford and the Boston and Maine railroads, about 25 miles northwest of Boston. Lowell, formerly Chelmsford, was founded in 1822, by the «Merrimac Manufacturing Company,» and named in honor of Francis Cabot Lowell (q.v.). In four years it was incorporated as a town, and in 1836 it was chartered as a city known as the «Workshop of the World.» The city now has an area of over 14 square miles. The city is noted for its great number of manufactories and its large annual output of manufactured articles. The power is obtained from the falls of the Merrimac which here descend 32 feet and from the Concord River; but 80,000 horse-power steam power is used. The «Proprietors of Locks and Canals» was organized early in the 19th century, for the purpose of obtaining and supplying power for cotton factories. The canal system was nearly completed in 1825, but the first canals were more like ordinary ditches; now they are walled and fitted with locks and bridges, all of the best construction and latest improvements. They are so well built that the annual amount spent for repairs is comparatively small. By means of this canal system of seven and one-half miles water power is furnished to many factories in Lowell, then returned to the Merrimac to be used lower down the stream to turn the wheels for the mills in Lawrence.

Some of the manufacturing establishments are woolen and cotton factories, hosiery and knitting mills, carpet and felt factories, bleacheries, dyeing works, machine-shops, patent-medicine works, a cartridge factory and furniture factories. Lowell has many points of historic and scenic interest and a number of fine public buildings. The educational institutions are the State Normal School, the Rogers Hall School, the Lowell Textile School, Saint Patrick's Academy, a high school, and public and parish elementary schools. The city has the Lowell Hospital, Lowell General Hospital, Saint John's Hospital, Saint Peter's Orphanage, Theodore Edson Orphanage, Ayer Home for Young Women and Children, Saint Patrick's Home for Working Women and the Old Ladies' Home.

The annual amount of municipal expenditures is about $2,206,859.30; the principal items are for schools about $463,942; for hospitals, almshouses, etc., $120,000; for police department, $167,000; for the fire department, $193,000; for municipal lighting, $121,000; for waterworks, $240,000. The waterworks were built in 1873 at a cost of about $2,875,000. There are now about 130 miles of mains. The waterworks are owned and operated by the city. Pop. 106,294, about 40 per cent of whom are of foreign birth. Consult Drake, ‘History of Middlesex County’; ‘Illustrated History of Lowell.’

LOWELL INSTITUTE, a Boston institution founded with a bequest of $250,000 by John Lowell (1799–1836) for «the maintenance and support of public lectures, to be delivered in Boston, upon philosophy, natural history, the arts and sciences, or any of them, as the trustees shall, from time to time, deem expedient.» Edward Everett delivered the first lecture 31 Dec. 1839, since when the leaders in philosophy, art and science of the English-speaking world have delivered regular annual courses of lectures. The institute is managed by a single trustee, who must be a member of the Lowell family of Massachusetts. Consult Smith, H. K., ‘History of the Lowell Institute’ (Boston 1898).

LOWER CALIFORNIA. See California, Lower.

LOWER HELDERBERG, *in geology,* a series of Pentamerous limestone of eastern New York, well developed in the Hudson Valley region and extending southward along the Appalachians to eastern Tennessee. The upper part of the formation was called Scutella limestone by Vanuxem. The lower Helderberg includes also the impure limestones above the Encrinal limestone at Becrafts Mountain, near Catskill and southward. The upper Pentamerous is distinct at Schoharie and westward to the centre of New York State, where all the subdivisions merge together. In Tennessee, the limestones of this period abound in fossils and occur in Hardin, Henry, Denton, Decatur and Stewart counties. The maximum thickness is about 100 feet. In the Appalachian region in Pennsylvania the lower Helderberg, here of impure limestone, has a thickness of 100 feet or more in the middle belt, and 200 to 250 feet in the southeastern. Cement, lime and building stone are extracted from the series. See DEVONIAN SYSTEM.

LOWESTOFT, lō'stŏft, England, municipal borough, seaport, and summer resort of Suffolk, on the Great Eastern Railway, 117 miles northeast of London. It is divided by the Waveney into the old town on the north and South Lowestoft. It contains the 14th century church of Saint Margaret, town and county halls, a hospital, two foundation schools, an esplanade and Bellevue Park. The fish trade is important. The harbor is 48 acres in extent and has a depth of 16 feet at high water. Its industrial establishments comprise boat and shipyards, motor works, flouring and oil mills, rope works, etc. Cromwell took the town in 1643 and off the coast in 1665 the Dutch fleet was defeated by the Duke of York. In the 18th century there existed flourishing manufactories of china ware. Pop. 33,770. Consult Nall, 'History of Lowestoft' (London 1866).

LOWESTOFT PORCELAIN. One of the most interesting and prolonged controversies that was ever entered into by connoisseurs and collectors of «china» was concerning the term «Lowestoft» as applied to certain pieces of porcelain ware. William Chaffers, a former authority on ceramics, in his «Gallery» (1872) claimed that certain pieces of porcelain (now known to be «Canton ware») were made and decorated in the English village of Lowestoft. His argument was based on a system of forced circumstantial evidence. Sir Augustus Wollaston Franks (the great expert) disclosed, in 1878, the deception Chaffers had been innocently guilty of. Many pieces of this Oriental porcelain, especially in America, are still termed «Lowestoft» ware of which there is documentary evidence of their importation in American ships from the port of Canton, some of these pieces, with the heraldic bearings of the original owners, even have the word «Canton» and date of make as well as a picture of the ship that brought the ware to this country figuring in their decoration. Excavations (in the years 1902–04) made on the site where the factory was that tradition stated made such ware finally disposed of the contention. «Wasters» (defective pieces and fragments) and some molds were unearthed which show clearly that all stages of porcelain making were carried on at this spot. Research among contemporary literature and documents disclose the following interesting facts as to the history of this porcelain pottery: Hewlin Luson, of Gunton Hall, near Lowestoft, discovered in 1756 some kind of china clay and set up «a temporary kiln and furnace» at Gunton and put practical potters from London at work there. In fear of successful competition, London manufacturers bribed the workmen to spoil each batch baked in the experiment. Such discouragement stopped the work. The chemist Robert Brown in association with Philip Walker, Obed Aldred (bricklayer) and John Richmond started a kiln, next year, in Lowestoft (at Bell Lane). The same spoiling of the output by tampering with the workmen occurred. But the cause of the trouble was found out and precautions permitted success to attend later efforts. Gillingwater's contemporary 'History of Lowestoft' says they «have now established the factory upon such a permanent basis as promises great success» and they «employ a considerable number of workmen, and supply with ware many of the principal towns in the adjacent counties.» The pieces and molds unearthed prove the following wares were produced: «fluted cups, basins, cream jugs, sauce boats, teapots (one with a raised floral design dated 1761), cabbage jugs of Worcester pattern, openwork baskets,» also «birth plates» with a name and birth date inscribed across the piece, and souvenir pieces with the words: «A Trifle from Lowestoft» on them. A characteristic ware consisted of barrel-shaped mugs having a picture of a herring yawl painted on one side and a woman smoking a spit of herrings on the other. Proof is afforded by these wasters that forged marks of the factories that originated some of these wares were used; «Allen Lowestoft» is on some pieces. Lowestoft paste has creamy appearance sometimes hidden under a colored glaze making them look like Oriental ware; the glaze is mostly of pale bluish color, sometimes bluish green, at other times colorless. Pieces show fine execution. It is a *soft* paste, not hard as in Oriental ware. The painting is in feeble drawing of a style like that of Saint Cloud, besides close copies of Worcester, Bow, Caughley, Plymouth, Bristol, Dresden, etc., decoration. Floral decoration is in conventional sprays, and diaper, trellis, scale patterns occur. Under the present nomenclature such ware is termed «true Lowestoft» and the Canton, long disputed pieces of hard paste are known as «Sino-Lowestoft» or «pseudo-Lowestoft.»

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CLEMENT W. COUMBE.

LOWICZ, lō'vĭch, Poland, town 50 miles southwest of Warsaw, on the Bzura. It contains an Abbey church, ancient château, military barracks, a gymnasium, and a monastery. Candles, flour, leather and soap are manufactured. No mention of the town is made prior to 1136. About 1350 it became the capital of a principality. In the Great War of 1914–18 Lowicz was occupied by the Germans, who heavily fortified it. In 1918 it became a part of the new Polish state. Pop. 14,500.

LOWIE, lō'ĭ, **Robert Harry,** American anthropologist: b. Vienna, Austria, 12 June 1883. At the age of 10 he was brought to the United States and in 1901 was graduated at the College of the City of New York and in 1908 at Columbia University. In 1908–09 he was assistant in the department of anthropology; in 1909–13 assistant curator, and since 1913 associate curator at the American Museum of Natural History, New York. In 1917–18 Dr. Lowie was associate professor of anthropology at the University of California. From 1906 to 1914 he conducted anthropological expeditions to the Indians of the northern plains, to Lake Athabaska in 1908, to the Plateau tribes in 1914–15, to Hopi in 1915, 1916. Since 1912 he has been associate editor of the *American Anthropologist* and in 1912–13 was editor of *Current Anthropological Literature*. He is a Fellow of the American Association for the Advancement of Science and of many other learned societies. He has published 'The Assiniboine' (1909); 'Social Life of the Crow Indians' (1912); 'Societies of the Crow, Hidatsa and Mandan Indians' (1913); 'The Sun Dance of the Crow Indians' (1915); 'The Age-Societies of the Plains Indians' (1916); 'Culture and Ethnology' (1917).

LOWNDES, lownz, **Marie Adelaide Belloc,** English author: b. 1868. She is a sister of Hilaire Belloc (q.v.) and was married to F. S. Lowndes in 1896. She has published 'Life and Letters of Charlotte Elizabeth, Princess Palatine' (1889); 'King Edward VII' (1901); 'The Heart of Penelope' (1904); 'The Pulse of Life' (1907); 'The Uttermost Farthing' (1908); 'When No Man Pursueth' (1910); 'A Child's History of the War' (1914); 'Good Old Anna' (1915); 'The Red Cross Barge' (1916).

LOWNDES, Rawlins, American statesman: b. in the West Indies 1722; d. 1800. His parents removed with him to Charleston when he was very young, and his career was ever after associated with that city. Having studied law he became an associate judge of the Colonial Court in 1766, and in that position opposed the Stamp Act. He assisted in outlining a new constitution for South Carolina in 1776, and in 1788 became president of the State. He was subsequently a member of the State legislature and vigorously opposed the ratification of the Federal constitutions.

LOWNDES, William, American legislator: b. Saint Barthomew's, Colleton County, S. C., 7 Feb. 1782; d. at sea, 27 Oct. 1822. He was taken to England when he was seven years of age, and sent for three years to an English grammar-school. On his return to Charleston he was graduated at Charleston College, studied law and was admitted to the bar in 1804, but he soon abandoned his profession to attend to his plantation. In 1806 Mr. Lowndes was elected to the lower house of the general assembly of South Carolina, retaining his seat until 1810, when he was chosen a member of Congress as a Democrat, and re-elected five times successively, serving from 4 Nov. 1811, till 8 May 1822, when failing health compelled his resignation. He was an earnest supporter of the War of 1812, and spoke frequently on matters pertaining to the army, the navy, the finances, the national bank, the Missouri Compromise, the Spanish treaty and the tariff. His friends regarded him as a suitable candidate for the Presidency, and he was nominated by the legislature of South Carolina. His health having been benefited by a visit to England in 1819, he decided to return to that country, and had embarked with his family from Philadelphia, but did not live to complete the voyage. As a debater he occupied the front rank, in spite of a weakness of voice caused by diseased lungs, while his memory was remarkably retentive. It is said that Henry Clay expressed the opinion that Lowndes was "the wisest man he had ever known in Congress." His portrait by Morse is in the Corcoran Gallery, Washington. Consult Ravenel, H. H. R., 'Life and Times of William Lowndes' (Boston 1901).

LOWRIE, low'rē, **Walter,** American legislator and philanthropist: b. Edinburgh, Scotland, 1784; d. 1868. At the age of seven his parents brought him to America and settled in Pennsylvania. Through his own exertions he qualified himself for the ministry. In 1811–18 he was member of the senate of Pennsylvania and from 1818 to 1824 was United States senator. He organized the congressional prayer-meeting and a total abstinence society. In 1836 Mr. Lowrie became corresponding secretary of the Western Foreign Missionary Society and subsequently for over 30 years was corresponding secretary of the Presbyterian Board of Foreign Missions.

LOWTH, Robert, English prelate and biblical scholar: b. Winchester, Hampshire, 27 Nov. 1710: d. London, 3 Nov. 1787. Educated at Winchester School and Oxford University, he became professor of poetry in the latter in 1741, and in 1750 archdeacon of Winchester. In 1753 he published his lectures on 'The Sacred Poetry of the Hebrews,' and became famous as one of the first biblical critics of his age. Ecclesiastical preferments followed, and he was made successively prebend of Durham, bishop of Saint David's (1766), of Oxford the same year and of London in 1777. In 1783 he declined the archbishopric of Canterbury. In 1758 he published a life of William Wykeham, in 1778 he published 'Isaiah, a New Translation,' with a preliminary dissertation and notes, which was highly commended.

LOWVILLE, lō'vĭl, **N. Y.,** village, county-seat of Lewis County, on the New York Central and Hudson River railroad, about 100 miles northwest of Albany and 60 miles north by west of Utica. It is situated in an agricultural section, and the industries of the village are connected chiefly with hop-growing and with farm and dairy products. Its trade is principally in hay, grain, vegetables and the noted Lewis County butter and cheese. The principal buildings are the town-hall, the county buildings, a clubhouse and the Lowville Academy. The academy library has about 5,000 volumes. The waterworks are the property of the municipality. Pop. 2,940.

LOYAL AMERICAN LIFE ASSOCIATION. Incorporated in November, 1896, in Illinois as a fraternal beneficiary society. Home office in Chicago since October 1911; before that date in Springfield. Does life insurance business, and operates actively in 25 States. On 1 Jan. 1916 had over 600 local branches. On same date this Association had 13,000 policies outstanding with $13,500,000 of insurance in force, and has paid benefits in sum of $3,300,000. Has $400,000 in assets. Last annual valuation showed 101.24 per cent of solvency. Business in excellent condition. It has a good form of representative government and ritualistic work that is patriotic, charming and instructive. As a mascot it uses the "Spirit of 76," and of the best-known and most-beloved pictures in America. Its rates are based upon the well-known N. F. C. Table of Mortality with 4 per cent interest assumption. Annual valuations are made upon the same basis. It now issues ordinary Whole Life Policies exclusively. Its rates are from 15 per cent to 40 per cent lower than old line rates for same kind of policy. Besides a death benefit, the Association voluntarily pays nine other benefits for injuries arising from accident. Its low cost, liberal benefits and privileges constitute a very attractive life insurance proposition. Just recently the Association has begun a national advertising campaign for agents and policyholders. The Association is conservatively managed.

LOYAL LEGION OF THE UNITED STATES, Military Order of the, was the first society formed by officers in the Civil War, who were honorably discharged. Its objects are to cherish the memories and associations of the Civil War, to strengthen the ties of fellowship and sympathy, to relieve the widows and children of dead companions of the order and to advance the general welfare of the soldiers and sailors of the United States. On the day after the assassination of President Lincoln, Col. S. B. Wylie Mitchell, Capt. Peter D. Keyser, M.D., and Lieut.-Col. T. Ellwood Zell met in Philadelphia to arrange for a meeting of ex-officers of the army and navy to adopt resolutions relative to the death of President Lincoln. It was decided to effect a permanent organization, and an adjourned meeting was held for this purpose in the hall of the Hibernia Fire Company in Philadelphia 3 May 1865. Eligibility to membership is as follows: Original companions of the first class — commissioned officers and honorably discharged commissioned officers of the United States army, navy and marine corps, regular or volunteer, including officers of assimilated or corresponding rank by appointment of the Secretary of the War or Navy, who were actually engaged in the suppression of the Rebellion prior to 15 April 1865, or who served under the President's call of 15 April 1861; or who, having served as non-commissioned officers, warrant officers or enlisted men, during the War of the Rebellion, have since been or may hereafter be commissioned as officers in the United States regular or volunteer army, navy or marine corps. All midshipmen in the United States navy and all cadets of the United States army, who, while pursuing their course in the United States Naval Academy or the United States Military Academy, actually rendered service. Hereditary companions of the first class. The direct male lineal descendants, who shall have attained the age of 21 years, of deceased original companions of the first class, and of deceased officers not members of the order, but who were eligible as such, and whose direct descent shall in every case be traced anew from the original founder of the membership in the order, or from the deceased eligible officer, and not otherwise. Any original companion having no direct lineal male descendant may, by writing, filed with the recorder of his commandery, nominate a companion of the second class from among the collateral male members of his family, descending only from his own brother or sister, and the person so nominated when he shall have attained the age of 21 years shall become eligible to membership for life in the second class. Second class — the sons, and if there be no sons, the grandsons, of living companions of the first class, whether original, in succession, or by inheritance, who shall have attained the age of 21 years, shall be eligible to membership. Third class.— Companions of this class are those gentlemen who in civil life during the Rebellion were specially distinguished for conspicuous and consistent loyalty to the national government and were active and eminent in maintaining the supremacy of the same; and who, prior to 15 April 1890, were elected members of the order pursuant to the then existing provisions of the Constitution, the power to elect such having ceased at that date. There are State commanderies in Pennsylvania, New York, Maine, Massachusetts, California, Wisconsin, Illinois, District of Columbia, Ohio, Michigan, Minnesota, Oregon, Missouri, Nebraska, Kansas, Iowa, Colorado, Indiana, Washington, Vermont and Maryland. The total membership in 1917 was 6,914.

LOYAL ORANGE INSTITUTION. See ORANGEMEN.

LOYAL TEMPERANCE LEGION, an organization of children founded in 1886, by the Woman's Christian Temperance Union, for the purpose of teaching children the evil effects of alcohol, tobacco and other narcotics. The graduates, who follow a systematic course of instruction, are organized into State legions, holding annual conventions. There are upward of 100,000 members in the United States.

LOYALISTS, or TORIES, in American history, those persons who remained loyal to Great Britain during the Revolutionary War. The issue of independence divided the American colonies into two parties: Whig and Tory, or Patriot and Loyalist. No contemporary figures exist which enable the respective numbers of the two parties to be definitely stated. They varied from time to time and from colony to colony. The Loyalists maintained that in the colonies as a whole they were in the majority. On the other hand, John Adams and others of the Patriot party held that the Loyalists constituted only a third of the population, and this estimate seems to be generally accepted by historians. The proportion varied greatly, however; the Patriots were clearly in the majority in New England and Virginia. In North Carolina the two parties were about evenly divided, in South Carolina the Loyalists were the more numerous, and in Georgia they were much more numerous. In New York, New Jersey, Pennsylvania, Delaware and Maryland the Loyalists were very strong, although probably in the minority. Pennsylvania seems to have had the largest absolute number of Loyalists.

It is probably impossible to draw any deductions from the distribution of racial elements. New England and Virginia, where the Patriots were strongest, were almost exclusively British in population (about 99 per cent and 94 per cent respectively), but so also was South Carolina, where the Loyalists were in the majority. New York, however, was 16 per cent Dutch, and Pennsylvania was 26 per cent German, and in these States the Loyalists were very strong. The total free population of the colonies in 1780 is estimated at 2,453,000, and was distributed racially about as follows: British, 91.8 per cent; German, 5.6 per cent; Dutch, 2 per cent; all others, less than 1 per cent.

The Loyalists took in all classes of the population. In New England the more substantial and better educated citizens, office holders and members of learned professions tended to be Loyalists; others were adventurers who adhered to England with the hope of gain or official preferment. The Loyalists probably contributed about 60,000 men to the military forces in America.

In all the States severe laws were enforced against the Loyalists, and it is estimated that nearly 200,000 left the country during or at the close of the Revolution. Between 40,000 and 50,000 Loyalists were said to have fled to Canada and settled mainly in the Maritime Provinces prior to 1786. Confiscation of Loyalist property was resorted to in all the States. In New York alone the sales of confiscated property brought over $3,500,000. Consult Flick, A. C., 'Loyalism in New York during the American Revolution' (New York 1901); Myers, T. B., 'The Tories or Loyalists in America' (Albany 1882); Ryerson, E., 'Loyalists of America, 1620–1816' (1880); Sabine, L., 'Biographical Sketches of Loyalists of the American Revolution with an Historical Essay' (2 vols., Boston 1864); Van Tyne, C. H., 'The Loyalists in the American Revolution' (New York 1902). See AMERICAN LOYALISTS.

LOYALISTS IN CANADA. In the 20th century it is easy to review without prejudice the motives and sacrifices of those Americans who chose to adhere to British allegiance when the 13 colonies declared themselves independent States. That the great majority of the Loyalists, or "Tories," as they were called by their enemies, were sincerely devoted to the royal cause there can be no sensible doubt, and official records recently brought to public notice present a pathetic picture of the sufferings and losses endured by the unfortunate supporters of British rule in the War of the Revolution. While as a result of that struggle the United States secured their independence, they also lost a host of valuable citizens who emigrated chiefly to Canada, where they established new homes and helped to strengthen Great Britain's hold on that portion of her empire. The descendants of those emigrants compose a large and influential part of Canada's population, and the names of men prominent in the politics, the professions and industries in the Dominion can be traced back to time-worn folios which tell the story of the plea of the poverty-stricken refugees for aid from the motherland.

The migration of Loyalists to Canada began as early as 1774, before the actual clash between the colonies and British authority. This was due to the fact that families which found themselves menaced and beset on account of their unpopular opinions saw no safe refuge nearer than Canada. The movement continued throughout the war, varying in degree with British success and defeat, until the surrender of Cornwallis extinguished any remnant of hope in the breasts of the royal adherents, who hastened in multitudes, by land and sea, to seek shelter and protection in the Canadian provinces. Many who tried to live down the past, trusting that, with hostilities over, their former attitude would be pardoned, if not forgotten, found their situation intolerable and followed in the footsteps of earlier refugees, and this went on until 1789, when the Loyalist migration ceased.

The total number of Loyalists who settled in Nova Scotia, New Brunswick, Cape Breton and Prince Edward Island is estimated at not less than 35,000, of whom about 30,000 went from New York, although probably the homes of many of these had been elsewhere before they sought shelter in that final stronghold of the British. In 1791 the English-speaking population of Lower Canada had increased to about 20,000, owing chiefly to the Loyalist arrivals, and in Upper Canada 10,000 Loyalists settled in 1783 alone; the next year the population had doubled and in 1791 it was estimated at 25,000. The province of Ontario may be said to owe its foundation to American Loyalists.

The British government and the provincial authorities extended cordial and liberal aid to the exiles. Those who were transported at the expense of the government received provisions for one year on leaving New York, and were supplied with rations regularly as long as their necessities continued. They also received clothing, grants of land and assistance in stocking their farms, building homes and clearing and cultivating the land. Tools and arms were also distributed.

The British Crown and Parliament took steps in July 1783 to compensate the refugees from the United States for injuries suffered through their loyalty and a commission consisting of five members was appointed to examine into and classify the losses and services. The following were held to be entitled to compensation: (1) Those who had rendered services to Great Britain; (2) those who had borne arms against the Revolution; (3) uniform Loyalists; (4) Loyalists resident in Great Britain; (5) those who took oaths of allegiance to the American States, but afterward joined the British; (6) those who armed with the Americans and later joined the British army or navy.

Compensation was not allowed for anticipated professional profits, losses in trade or through depreciated paper money, or losses caused by the British army, which were accounted as obligations of the British government outside the province of the commission. By the Treaty of Peace between the United States and Great Britain it was stipulated that Congress should earnestly recommend to the States the restoration of the rights and possessions of "real British subjects," and of Loyalists who had not borne arms. The recommendation was without effect. Nevertheless the commission required evidence in support of the claim that property had been confiscated and had not been restored. Notwithstanding the bitter feeling in the United States toward the Loyalists, the requisite evidence appears to have been readily supplied to claimants by American local authorities.

Apart from the expenditures already noted in supporting and establishing Loyalists on their farms, and which amounted in Upper and Lower Canada to probably $4,000,000, the British government paid $9,448,000 on 1,680 claims examined and allowed by the commission appointed under the Act of 1783. This commission sat in London. In 1785 two commissioners were sent to Canada to examine claimants who had failed, through ignorance, inability or other causes, to present their claims in London. This commission allowed $2,745,000 on 1,401 claims. After the departure of the commission claims continued to be sent to Great Britain, where many more were allowed. The claims ranged in amount from $60 to $777,000, and the sums allowed from $50 to $221,000, the latter amount having been granted to Sir John Johnson, the noted «Tory» commander. Every one of the 13 States — or 14, including Vermont — was represented in the number of claimants, as follows: New York, 941; South Carolina, 321; Massachusetts, 226; New Jersey, 208; Pennsylvania, 148; Virginia, 140; North Carolina, 135; Georgia, 129; Connecticut, 92; Maryland, 78; Vermont, 61; Rhode Island, 41; New Hampshire, 31; Delaware, 9; total, 2,560.

It is estimated that the British government expended in all about $30,000,000 during the Revolution and afterward in aiding Loyalists in America and Great Britain. Those who settled in Canada soon became self-supporting and as a rule prosperous. In 1789 it was decreed that all Loyalists should be «distinguished by the letters U. E. affixed to their names, alluding to their principle, the Unity of the Empire.» This distinction has fallen into disuse, although occasionally recalled when some eminent Canadian of old Loyalist stock passes away.

LOYALTY ISLANDS, a group in the Pacific Ocean, 60 miles east of New Caledonia, of which French colony they form a dependency. They consist of the islands Uvea (Uea), Lifu and Marè, with many small islands. Total area, about 800 square miles. Water is scarce, but some fruits, vegetables and grains are cultivated. Copra and rubber are the chief exports. The inhabitants are of mixed descent, Melanesian and Polynesian, and nearly all Protestants. Pop. about 15,000.

LOYOLA. Saint Ignatius Loyola, founder of the Society of Jesus: b. 1491, at the Castle of Loyola, Azpeitia, in Guipuscoa, Spain; d. Rome, 31 July 1556. He was the youngest son of Beltrán Yañez de Oñez y Loyola and Marina Saenz de Licona y Balda. Iñigo, as the child was baptised, after Saint Enecus or Innicus, abbot of Oña, adopted the name Ignatius during his life in religion.

I. Early Years, 1491–1521.—The youth of Ignatius was mostly passed in the chivalry and grandeur that surrounded the court of Ferdinand and Isabella, rulers of Castile and Aragon. He became an officer of the army, and commanded the Spanish forces during the siege of Pampeluna by the French. So soon as their brave leader was wounded, the garrison surrendered, 21 May 1521. A cannon ball had lacerated the left and broken the right leg of Ignatius. Surgery was then primitive; so the shattered shin caused much trouble. It was set, broken and then reset; and a protruding bone was sawed off. In the end, the healing leg had to be stretched with weights. During days of enforced convalescence, the soldier called for some light reading,— the tales of chivalry that then had a vogue. None was to hand, at Loyola Castle; so the 'Life of Christ' by Ludolph of Saxony and the lives of the saints were brought to the sick man. At first his interest was that of a knight in the tales of deeds done by heroes. Then his own knightly deeds began to stand out in bold relief and strange contrast over against the chivalry of the knights of Jesus Christ. He mused on the possibilities of imitation and rivalry. The heroism of each saint opened out to him a new vista of life, and aroused the thought, «Why not I?» The truth came home that there was a Captain, worth far more than any earthly leader; the battles fought by that Captain were entirely different from those that the high-spirited Spaniard had been wont to esteem. The Kingdom of Christ loomed larger and larger. He saw that the principles of action of his whole life would have to be readjusted; they were selfward, and not fully Christward.

II. Preparation for the New Knighthood, 1522–34.— So soon as health was restored Ignatius, with that singleness of purpose which was his characteristic, set out at once to become a knight of Jesus Christ in the Kingdom whose dynamic power is Christ-love. He made a pilgrimage to Montserrat, put his soul right with God by a general confession, laid his sword and poniard at Our Lady's altar, spent the night there in a vigil at arms, received communion next morning,— the Feast of the Annunciation 1522,— gave his courtly raiment to a beggar, donned a sack-cloth tunic and started the war against self-love for the Reign of Christ on earth. A year of solitude, prayer and penance was then spent in a cavern, the «Santa Cueva,» just outside Manresa. The spiritual experiences of this year, its severe mortifications, scruples, extremes of consolation and desolation, wonderful graces, visions and miraculous interventions, were all formative of his character and of the system of asceticism which has become famous by the little book called «The Spiritual Exercises.» Next year, 1523, he made a pilgrimage to the Holy Land, to suffer the poverty, contumely and opprobrium which were emblazoned on the standard of his King. The plan was foiled by well-meaning persons of authority in the Holy Land, who deemed that the presence of the enthusiastic pilgrim would impede their work. So Ignatius returned to Barcelona. He now resolved to draw others to the standard of Christ; and to that end began a course of studies that lasted 11 years. At 33 (1524) the intrepid patrician, in the garb of a poor man, took up the elements of Latin together with a class of mere schoolboys. In two years, 1526, he matriculated at the University of Alcalá. Here the Inquisition looked askance at the zealous student's doctrine, imprisoned him for two months, and forced him to Salamanca, 1527. Studies at this university town were equally impossible, because of citation and imprisonment by the Inquisition. So Ignatius betook him to the University of Paris, February 1528. At Paris many trials came round from poverty and misunderstandings; but studies were successfully pursued, and much of value was learned in the science of education and that of the care of souls. Ignatius took his licentiate in theology in 1534, and his M.A. in 1535. Ill health prevented him from going up for the doctorate in theology. Meanwhile, a band of faithful followers were gathered. They were Blessed Peter Fabre and Claude Le Jay, Savoyards; Saint Francis Xavier, of Navarre; James Laynez Alonso Salmerón and Nicholás Bobadilla, Spaniards; Simon Rodriguez, a Portuguese; Jean Codure and Paschase Broët, Frenchmen. These 10 knights, all thoroughly educated university men, formed the nucleus of the Society of Jesus.

III. Founder of the Society of Jesus.— 1534–56.— On 15 Aug. 1534, the companions took the vows of poverty and chastity, at Montmartre, Paris, and founded the Society of Jesus. They also bound themselves to make a pilgrimage to the Holy Land after two years; or, if this were not feasible, to put themselves at the disposal of the Holy Father. Works of charity occupied them for several years. In 1537, with permission of the Holy See, all were ordained to the priesthood. About this time, on his way to Rome, Ignatius had a vision of the Eternal Father directing him to companionship with Jesus, and saying: «Ego vobis Romæ propitius ero.» This vision fixed the knight's determination to call his society «La Compañia de Jesus,» in keeping with the military idea of recruiting a body of picked knights, priests of singular worth and noteworthy education, who should be a select corps of trained warriors, named after its Captain, Jesus Christ, and ever ready at the beck of the Pope to go even to the utmost ends of the earth to spread the Kingdom of the Saviour. There were delays and difficulties at Rome. The plan received pontifical viva voce approval, 3 Sept. 1539; and, on 27 Sept. 1540, the bull «Regimini militantis ecclesiæ» of Paul III established the Society of Jesus as a new religious order. In April 1541 Ignatius was elected the first general of the society. He and his companions made their solemn profession, the 22d of that same month, at Saint Paul's outside the walls. Within a very short time, the new religious were sent on important missions to various parts of the world: Rodriguez to Portugal, where he founded a province; Xavier to India; Salmerón and Broët to Ireland; Fabre, Canisius, Bobadilla and Le Jay, to Germany. In 1546 Laynez and Salmerón were papal theologians at the Council of Trent; here also Le Jay, Covillon and Canisius represented various bishops. Ignatius remained at Rome, to draw up the constitution (Cf. art. Jesuits). What pains he took in this work, and how he was guided therein by extraordinary graces,— illuminations of the reason, inspirations of the will and visions,— may be established by a journal of prayer still extant, wherein are recorded the deliberations for 40 days upon one vital issue in the matter of religious poverty. Ignatius founded the Roman College in 1551, and the German College at Rome in 1552. He died in 1556, the 16th year after the canonical institution of the Society of Jesus. It had grown to a membership of about 1,000, divided into 12 provinces, and toiling in more than 100 religious houses. The saint was beatified by Paul V, 27 July 1609; and canonized by Gregory XV, 22 May 1622. His remains rest under a beautiful altar, in the church of the Gesu, Rome.

IV. "The Spiritual Exercises."—The spirit of Saint Ignatius was Pauline,— intrepid yet tender; motivated by two great principles,—love of Jesus Christ and zeal for the salvation of souls. These two principles were brought together in his motto: A. M. D. G., «Omnia ad Majorem Dei Gloriam» (*All for the greater glory of God*). It was this spirit, which breathed in «The Spiritual Exercises,» a method of asceticism, that is the very soul of the constitutions and activities of the Society of Jesus. This little book is said to have converted more souls than it contains letters. Certainly the results it has produced down the centuries cannot be exaggerated. The importance of its method is proved by the mere fact that 292 Jesuit writers have commented on the whole work. The purpose of the Exercises is definite and scientific upbuilding of the reason, will and emotions, by meditation and contemplation on the fundamental principles of the spiritual life and by other exercises of the soul. First, God is rated rightly as the soul's end and object. Reason is convinced that God is the end for which the soul is created, and all things else are only means to bring the soul to God; hence it follows that that is good which leads the soul Godward, and that is evil which leads the soul awayward from God. The soul's awaywardness from God results in sin; so sin is studied both in itself and in its consequences to the soul. Secondly, Jesus Christ is put in His place in the soul, by meditations on His ideals and contemplations on His private and public life. The soul now aspires to the very height of enthusiastic and personal love to Him; and to the most self-sacrificing generosity in following the evangelical counsels. Thirdly, the high resolves of the soul are confirmed by the imitation of Christ in His passion. Lastly, the soul rises to a sublime and unselfish joy, purely because of the glory of its risen Lord; and leaps with rapturous exultation into the realms of unselfish and perfect love of God, such as Saint Paul evinced when he cried out: «To me, to live is Christ; to die were gain» (Philippians i, 21). See also article Spiritual Exercises.

Bibliography.— 'Monumenta Historica Societatis Jesu' (1894, 36 vols., especially the 'Monumenta Ignatiana,' 9 vols., containing the 'Autobiography' of Saint Ignatius); Astrain, 'Historia de la Compañia de Jesus en la Asistencia de España' (Vol. I, 1902); Tacchi-Venturi, 'Storia della Compagnia di Gesú in Italia' (1909); Duhr, 'Geschichte der Jesuiten in den Ländern deutscher Zunge' (1907). More than 130 lives of Saint Ignatius have been written; important are Ribadeneira (1572), Clair (1894), Bartoli (1650), Bouhours (1679), Stewart Rose (1891) and Thompson (1910).

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LOYOLA, Martín García Oñez de, Spanish cavalier, nephew of Saint Ignatius Loyola: b. Guipúzcoa, about 1548; d. 1599. He joined the knightly order of Calatrava; came to America, where, in 1572, he fought against the Inca, Tupac Amaru, whose niece he married and through her secured some of the Inca's fortune. In 1592 he was made governor of Chile. The seven years of his administration were occupied with the campaign against the Arancanians, the most redoubtable opponents of Spain in the New World. Loyola was slain by the Indians at Curalava. Consult Arana, Diego Barros, 'Historia generale de Chile' (4 vols., Santiago de Chile 1884–85).

LOYOLA UNIVERSITY, Chicago, Ill., Saint Ignatius College, the Arts Department of Loyola University, was founded in 1869 in Chicago by the Rev. Arnold Damen, S.J., and fellow-priests of the religious order of the Society of Jesus, or Jesuits. It is the oldest and largest Catholic institution of higher learning in Chicago. At the time of its foundation, Saint Ignatius College was in the suburbs of the city, but owing to the unprecedented growth of Chicago the college has long since become a down-town institution. Realizing the need of providing suitably for the future growth of the college, the board of trustees found it advisable to purchase in 1906 20 acres of ground on the north shore. On this site two buildings have been erected — the Loyola Academy and the Michael Cudahy Science Hall — the latter the gift of the man whose name it bears. Loyola University, which is a development of Saint Ignatius College, was incorporated in 1909. A department of law was opened in 1908 under the name of the Lincoln College of Law, which was afterward changed to the Loyola University College of Law. The university was associated with the Illinois Medical College in 1909 and since 1910 with the Bennett Medical College. In 1917 it purchased the Chicago College of Medicine and Surgery and now conducts its medical department under that name. For several years an affiliation was maintained with the Central States College of Pharmacy, but in 1917 it was discontinued. A department of sociology was opened in 1913 and located in the Ashland Block in the loop district of Chicago has been unusually successful. A junior college in engineering is maintained. Two high schools are under the control of the university authorities. Present enrolment is 1.170 in collegiate and graduate studies; 850 in high schools. The institution is a member of the Federation of Illinois Colleges.

LOYSON, Charles, shärl lwä-zôṅ (known by his monastic name, PÈRE HYACINTHE), French ecclesiastic: b. Orleans, 10 March 1827; d. 1912. He studied in the College of Pau and the ecclesiastical college of Saint Sulpice, was ordained priest in 1850, taught philosophy at the Seminary of Avignon and theology at that of Nantes, entered the Carmelite order, and became renowned as a preacher at Lyons, Bordeaux, Nantes and Paris. But his unorthodox utterances soon drew the censure of ecclesiastical authority, and his superiors prohibited him from preaching. He then left the Order, and refusing to remain silent he was excommunicated. In 1869 he visited the United States, where he was heartily welcomed. In 1872 he married an American lady in London. He protested against the dogma of papal infallibility, attended the Old Catholic Congress in Munich, fraternized with Protestants, but repeatedly declared that he had no intention of leaving the Catholic Church. In 1873 he became pastor of an Old Catholic church at Geneva, and the founder of the Christian Catholic Church of Switzerland. In 1878 he opened in Paris an independent church, the Eglise Gallicane, holding communion with the Old Catholic and Anglican churches. Père Hyacinthe traveled extensively and during a visit to the Orient in 1900–01 with his wife was welcomed by patriarchs of the Eastern churches. From 1901 he ministered again to Old Catholic and Protestant churches in Switzerland. Among his writings are 'La société civile dans ses rapports avec le Christianisme' (1867); 'La Réforme Catholique' (1872–73; extended, 1867); 'Liturgie de l'Église Catholique-Gallicane' (4th ed., 1883); 'Mon Testament' (1893); 'Christianisme et Islamisme' (1895); and he edited the magazine *Catholique Française*. Consult Houtain, A., 'Vie du Père Hyacinthe' (in *Grande Revue*, Vols. LXXVII-LXXXII, Paris 1913).

LOZADA, lō-sä'dą, or **LOSADA, Manuel,** Mexican bandit and guerilla leader: b. near Tepic, about 1825; d. 1873. Lozada was a mestizo, with Indian, negro and white blood in his veins. He became a prominent leader among the Indians over whom his influence was very great. He resorted to banditry and with his followers forced tribute from the law-abiding citizens of the lowlands. When war broke out between the Conservative and Liberal factions Lozada allied himself with the former and during the French occupation of Mexico was an ardent supporter of Emperor Maximilian, by whom he was commissioned a general of division. By Napoleon III Lozada was decorated with the ribbon of the Legion of Honor. While Maximilian was in power Lozada was virtual autocrat of Tepic. After the fall of the empire he opposed Juarez and in 1872 led a force against Guadalajara. He was unsuccessful but managed to elude his pursuers until the following year when he was taken and summarily executed.

LOZANO, lō-thä'nō, **Pedro,** Catholic missionary: b. Spain, date unknown; d. 1759. He became a member of the Society of Jesus, was sent on the South American mission and subsequently was appointed professor at the College of Córdoba at Tucumán. Charlevoix's histories owe much to the material furnished by Father Lozano, who published several works, including 'La descripción chorográfica del terreno, ríos, árboles y animales de las dilatadisimas provincias del Gran Chaco Gualamba y de los ritas y costumbres de las innumerables naciones barbaras é infieles que la habitan' (Córdoba 1733) and 'Historia de la Compañia de Jesús en la provincia del Paraguay' (2 vols., Madrid 1754–55).

LOZEAU, lō'zō, **Albert,** Canadian poet: b. Montreal, 1875. He was educated in the schools of his native city; became an invalid in his youth and has of necessity lived in retirement. His poetry is very popular in Quebec and has been praised by several Parisian critics. It breathes the introspection caused by his detachment from active affairs. His works include 'L'ame solitaire' (1907); 'Billets du soir' (1911), and 'Le miroir des jours' (1912). Consult Roy, Camille, 'French-Canadian Literature' (in 'Canada and its Provinces,' Vol. VI, Toronto 1914).

LOZNITZA, lōs'nĭt-sạ, Serbia, town situated on the Drina, 65 miles west-southwest of Belgrade. It was taken by the Austrians in the War of 1914–18, the passage of the river being forced at this point after a heavy bombardment. When the Serbian forces assumed the offensive and forced the Austrians out of Serbian territory Loznitza was the scene of the last stand of the invaders; they were finally obliged to evacuate the town but in their retreat set it on fire. See War, European — Serbian Campaign.

LUALABA, loo-ä-lä'bä, Central Africa, a head-stream of the Kongo River, which rises near Kabinda on the southern boundary of the Kongo Free State, receives several affluents such as the Lufira and Lubudi, passes through a hilly, forest and lake region, and after a course of about 650 miles, the last 250 of which are navigable, unites with the Luapula (q.v.) at Ankoro to form the Kongo.

LUANG-PRABANG, loo'äng-prä'bang. (1) Native state of Indo-China under the protection of France. (See French Indo-China). (2) The capital of the state of the same name, in Indo-China, situated on the Mekong at its juncture with the Nam-kan, 250 miles west-southwest of Hanoi. A pagoda on a hill is a feature in the city's centre. There are several other pagodas, temples and a royal palace. The town is also the seat of a French resident-agent. Pop. 40,000.

LUAPULA, loo-ä-poo'lä, Central Africa, a river, the chief of the two principal head-streams of the Kongo. It rises as the Chambezi south of Lake Tanganyika, near Fwamba on the Stevenson Road, flows southwest through Lake Bangweolo whence it issues as the Luapula, flows northward through Lake Moero, then northwestward until it unites at Ankoro with the Lualaba (q.v.) to form the Kongo.

LUBANG, loo-băng', Philippines, the largest and only inhabited island of the group of the same name lying at the western entrance of the Verde Passage between Luzon and Mindoro, southwest of Manila. The island of Lubang is 17 miles in length from northwest to southeast; area, 51 square miles; area of group, 76 square miles. The interior of the island is mostly mountainous, but the coasts are low. The chief town is Lubang on the north coast, which has considerable native trade; the only port safe for all vessels at all seasons of the year in Tilig, on the northeast coast. Civil government was established in these islands in 1901, and in June 1902 they were detached from the province of Cavite and annexed to the province of Marindique. Pop. 3,000.

LUBAO, loo-bä'ō, Philippines, a pueblo of the province of Pampangas, Luzon, situated on the northwestern channel of Pampanga delta, five miles south of Bacolor. It is the trade centre of an agricultural region cultivating sugar, rice and indigo. Pop. 21,200.

LUBBOCK, lŭb'ŏk, **Francis Richard,** American governor: b. Beaufort, S. C., 16 Oct. 1815; d. Austin, Tex., 1905. After receiving an academic education Lubbock was engaged in business in South Carolina, in New Orleans and finally in Texas. Before the Civil War he held several minor offices and clerkships. In 1857 he was elected lieutenant-governor and in 1861 governor. He refused re-election and as soon as his term expired Lubbock entered the military service as colonel on the staff of President Davis. He was captured with Davis in May 1865 and imprisoned until December. Lubbock then entered business, first at Houston and later at Galveston. In 1878 he was elected State treasurer and was three times re-elected. He wrote a volume of reminiscences called 'Six Decades in Texas' (1900).

LUBBOCK, John, 1st Baron Avebury, British archæologist and man of science: b. London, 30 April 1834; d. Kingsgate Castle, near Ramsgate, Kent, 28 May 1913. He was educated at Eton and joined the banking business of his father, Sir John William Lubbock (q.v.), in 1848, becoming a partner in 1856. He rose to great eminence in his profession, and was appointed to various honorable and responsible posts in connection with it. He entered Parliament in 1870 as member for Maidstone in the Liberal interest, and from 1880 till 1900 sat for London University, from 1886 as a Liberal Unionist. In 1900 he was raised to the peerage as Baron Avebury. He was a recognized authority on financial and educational questions, and his name is associated with three notable measures of social reform — the Bank Holidays Act, 1881, which secured three national holidays to the workers, on Easter Monday, Whit Monday and the first weekday after Christmas Day. Each of these is often referred to as "Saint Lubbock's Day." He also instituted the Shop Hours Regulation Act, 1885, which limited the hours of young persons under 18, and the Shop Hours Act, 1904, which made it compulsory for every store to close for half-a-day once a week. He was at various times chairman or member of a number of royal commissions; the Common Committee of Public Accounts; on the Advancement of Science; the Public Schools; International Coinage; the Gold and Silver Commission; and the Secondary Education Commission. He was the first president of the Institute of Bankers and chairman of the Council of Foreign Bondholders. He was an outstanding supporter of the principle of proportional representation. But he was still more distinguished as a man of science. His studies were chiefly directed toward the ancient remains and history of mankind; and the habits of insects, particularly of wasps, ants and bees. Some of his books had enormous circulations and did much to promote popular interest in science, and they possessed the authority that is based on exhaustive personal investigation. A complete list of his writings would make quite a formidable catalogue. They may be divided into four classes: (1) Biology: 'British Wild Flowers in Relation to Insects' (1873); 'Origin and Metamorphoses of Insects' (1873); 'Fruits, Flowers and Leaves' (1886); 'On Seedlings' (1892); 'Buds and Stipules' (1899); 'Notes on the Life History of British Flowering Plants' (1905); (2) Geology, Palæontology and Physical Geography; 'Prehistoric Man' (1865); 'The Origin of Civilization' (1870); 'The Scenery of Switzerland' (1896); 'The Scenery of England' (1902); the two latter of importance as explanations of how the present-day scenery has come to be what it is. (3) Economics: 'A History of Coinage' (1902); 'Free Trade' (1904). (4) Miscellaneous: 'Fifty Years of Science' (Presidential address to the British Association, 1881); 'The Pleasures of

Life' (1887); 'Peace and Happiness' (1909); and a number of other essays and addresses, of which a very popular one was an attempt to specify the best 100 books in the world's literature. These have frequently been published in sets and are known as "Lubbock's Hundred Best Books."

LUBBOCK, Sir John William, English astronomer and mathematician: b. Westminster, London, 26 March 1803; d. 20 June 1865. He was graduated from Trinity College, Cambridge, in 1825; became a banker; found an avocation in scientific studies; made particular investigations in physical astronomy and Laplace's theory of probability; and was the first vice-chancellor of London University (1837–42). Among his scientific writings are 'An Elementary Treatise on the Computation of Eclipses and Occultations' (1835); 'An Elementary Treatise on the Tides' (1839); and 'On the Gnomonic Projection of the Sphere' (1851).

LUBBOCK, Sir Nevile, English banker: b. 31 March 1839; d. 12 Sept. 1914. A brother of the first Lord Avebury (q.v.), he was educated at Eton. He became governor of the Royal Exchange Assurance Corporation; a director of the Colonial Bank; vice-president of the Royal Colonial Institute; and president of the West India Committee. He was created K. C. M. G. in 1899.

LUBEC, loo'bĕk, Me., town in Washington County, four miles south of Eastport. Fishing is the sole industry of the inhabitants. Smoked fish and sardines are exported. The water-supply system is the property of the municipality. Pop. 3,363.

LÜBECK, Germany, one of the three free city-states (see Free Cities) and a constituent of the German confederation, situated on a low ridge at the confluence of the Wackenitz with the Trave, 38 miles northeast of Hamburg and 12 miles from the Gulf of Lübeck, on the Baltic. It was anciently surrounded by walls and bastions, which have been leveled and converted into pleasant walks; but it is still entered by four gates and furnishes striking specimens of the architecture of the 15th and 16th centuries. Among the buildings are the cathedral, a structure of red brick, begun in 1173, surmounted by two spires 416 feet high, and containing a finely carved choir-screen; the Marienkirche (Saint Mary's Church), a fine specimen of early Gothic, the Ægidienkirche (Saint Giles' Church) and the Petrikirche (Saint Peter's Church); the town or senate house, an ancient Gothic building; the Hospital of the Holy Ghost (13th century); the Holstein Gate, with its two lofty towers, etc. There is a public library of about 130,000 volumes. Scholastic establishments include technical, architectural and naval schools. The city has fine municipal waterworks, electric lighting and a system of electric street railroads connecting the suburbs. The manufactures are comparatively unimportant, but the trade is extensive, especially with Hamburg, the Baltic ports and the interior of Germany. The Elbe-Trave Canal connects Lübeck and Lauenburg. Lübeck possesses a territory of 116 square miles and includes the port of Travemünde and several isolated portions in Holstein and Lauenburg. It has a senate of 14 members and a council of burgesses of 120 members. It became an imperial free city in 1226, and about 30 years later it became the head of the Hanseatic League. It is represented by one member in the Bundesrat and one in the Reichstag (q.v.). There is a court of first instance and a high court. Pop. of city about 116,599; of city and state about 130,000. The principality of Lübeck belongs to the grand duchy of Oldenburg and lies north of the state (pop. 41,300). Consult King, Wilson, 'Three Free Cities: Hamburg, Bremen, Lübeck' (London 1914).

LUBIN, David, American agriculturist, founder of the International Institute of Agriculture: b. Poland, of Jewish parents, 10 June 1849; d. Rome, Italy, 1 Jan. 1919. He was taken to England when he was two years old. On his father's death, David's mother married again and they emigrated to America. He received a scant education and at an early age was placed in a jewelry factory in Attleboro, Mass. Finding slight opportunity of advancement there he drifted to California. He reached Sacramento and after working at odd jobs he amassed sufficient funds to start a dry-goods store of his own. David dealt largely in overalls and thus came in contact with the farmers of California, and as he met them in person he learned something of their problems and his keen mind was soon interested. He bought a farm and became a fruit grower, retaining also his dry-goods business which had prospered. In his new vocation of farmer there came to him the idea of an international agricultural congress, whereby one side of the globe might learn what the other side was producing and how and at what cost. He began collecting statistics on the subject; studied plant life and domestic animals and made investigations into their diseases and sought remedies therefor. In 1904 Mr. Lubin found support in Italy for his projected international agricultural congress. King Emmanuel saw the need for such an institution and gave it his ardent support, giving a building for the congress and an annual income of $60,000. At the first gathering 40 nations were represented and Mr. Lubin was appointed the delegate from the United States by President Roosevelt. Mr. Lubin lived to see 53 nations taking part in the congress. He was responsible also for the introduction of the rural credits system in the United States and he brought about the passage of a measure in Congress for increasing the parcels post service for the benefit of the farmer, promoting direct selling and buying of farm produce through the mails. He also took a keen interest in farmers' co-operative societies and granges and was interested in oceanic shipping. He introduced the national marketing proposal on the lines of the German Landwirtschaftsrat. In 1913 on the occasion of the meeting of the congress in Rome Mr. Lubin received a silver cup as a token of appreciation of his efforts in originating the organization. Since that year he had lived in Rome much of the time. He published 'Let There be Light.' See International Institute of Agriculture.

LÜBKE, Wilhelm, vil'hĕlm lüb'kė, German historian of art: b. Dortmund, Westphalia, 17 Jan. 1826; d. Karlsruhe (Baden), 5 April 1893. He studied at Bonn and Berlin; held the chair of architecture at the Building Academy of Berlin in 1857–61; was professor of the history of art and archæology at the polytechnic school at Zürich 1861–66, at Stuttgart 1866–85 and at the high school in Karlsruhe 1885–93. Chief among his works are ‘Mediæval Art in Westphalia’ (1853), which at once gave him a high place among art critics; the ‘History of Architecture’ (‘Geschichte der Architektur,’ 1855), the first popular manual of the subject, and a great success: ‘Outlines of the History of Art’ (1860; 11th ed., 1891), translated into English by Clarence Cook, 1880; ‘History of the Renaissance in France’ (1868); ‘History of the Renaissance in Germany’ (1873); ‘Ecclesiastical Art in Germany’ (Eng. trans. by Wheatley, 1876); ‘History of Sculpture’ (Eng. trans. by Bunnet, 1878); ‘History of German Art’ (1888); ‘Recollections’ (1891). He was extremely versatile and previous to his work in art gave instruction in vocal and pianoforte music.

LUBLIN, loo'blĭn, Poland, capital of the government of Lubin, on the Bistritza, about 95 miles southeast of Warsaw. Lubin was, in the 12th century, a place of importance. The union of Poland and Lithuania was decreed at a diet which met here in 1568. There are at present some manufactures, chiefly woolen goods, agricultural implements and leather. There is a jail with which is connected a government cloth factory. It was the headquarters of the Russian 14th Army Corps. Lubin has a number of good educational institutions and a number of ancient buildings. Pop. 65,870, one-half of whom are Jews.

LUBLINSKI, loo-blĭn'skĭ, **Samuel,** German literary critic: b. Johannisburg, East Prussia, 18 Feb. 1868; d. Weimar, 26 Dec. 1910. He is the author of a number of dramas and a book attacking the naturalistic movement in the German literature of the last decade of the 19th century (‘Die Bilanz der Moderne,’ Dresden 1904).

LUBRICANTS, substances having a low degree of cohesion applied to solid surfaces rubbing against each other; the object being to reduce the friction at the points of contact. The theory as to lubricants is that they interpose an almost frictionless film between the surfaces to which they are applied. The requirements of a good lubricant, therefore, are a minimum of internal cohesion and sufficient body to resist being squeezed out of place by the pressure to which they may be subjected — as, for example, in the bearings of a heavy shaft. Other important qualities demanded are freedom from all corrosive ingredients and also from any component which has a tendency to absorb oxygen and become gummy. Lubricants for use in the cylinders of gasoline engines must possess the further qualifications of having a high flash point and a relatively very high fire point.

The lubricants generally in use belong to the group of oils and greases. Outside of these but one substance ranks with them in importance, and that is graphite. Although nearly all of the so-called non-drying oils and most of the greases have been used at one time or another as lubricants, it is now recognized that animal oils and fats are liable to decompose with use, developing acids which are corrosive, and thus destructive to the bearings in which they are used; and oils of vegetable origin have a tendency to become gummy within a brief period. For all fine machinery, therefore, the preferred lubricants are the mineral oils derived from crude petroleum. For many purposes, however, sperm oil, lard oil, whale oil, neatsfoot oil and tallow oil, among the animal oils, and olive oil, rape oil and castor oil among the vegetable oils are in considerable use, both alone and in mixtures with one another and with the various mineral oils. Solid tallow is also used in mixtures with various oils to form lubricating greases. Castor oil has proved of special value in lubricating the high-speed engines of the aeroplane and the racing automobile. Graphite, preferably of the “flake” type, is used on the finest of machinery, usually in mixture with oil or grease.

The fine lubricating oils are made from crude petroleum by first distilling off the naphthas and the illuminating oil, and then distilling the residue with superheated steam in a vacuum. The lower temperatures give the lighter spindle oils, and the higher give cylinder oils of greater viscosity up to a buttery paste, called cup grease. These lubricants are graded to extremes of nicety for the pressures under which they must work and the temperatures they must endure, and the manufacturers offer them in almost endless variety. Consult Archbutt, L., and Deeley, R. M., ‘Lubrication and Lubricants’ (London 1912); Battle, J. R., ‘Lubricating Engineer's Handbook’ (Philadelphia 1916); Hurst, G. H., ‘Lubricating Oils, Fats and Greases’ (London 1911).

LUCAN, lū'ka̤n (MARCUS ANNÆUS LUCANUS), Roman poet: b. Cordoba, Spain, 39 A.D.; d. 65. His father, a Roman knight, was the youngest brother of the philosopher Seneca. Lucan went to Rome when a child, and having early obtained celebrity, was forbidden by Nero, who himself aspired to literary honors, to recite in public. This induced Lucan to join the conspiracy of Piso. The plot was discovered, and Lucan, who is said to have informed against his own mother as accessory, was condemned to death. He chose the death of Seneca, and had his veins opened. Of his poems, only his ‘Pharsalia’ had come down to us, in which he narrates, in 10 books, the events of the civil war between Cæsar and Pompey. The poem is unfinished, and as it appears to have been composed at different times, it is uncertain whether it was left unfinished by the author or whether the latter part has been lost. In the earlier portions the liberal sentiments of the author are checked by deference to the emperor, in the latter he is inveighed against in unsparing language. The best editions are Burmann's (Leyden 1740), Weber's (Leipzig 1821–31) and those of Haskins (Cambridge, England, 1887), Hosius (Leipzig 1892) and Francken (Leyden 1896–97). Lucan has been translated into English by Rowe (1718) and by Ridley (2d ed., 1905). Consult Butler, H. E., ‘Post-Augustan Poetry’ (Oxford 1909).

LUCANIA, lū-kā'nĭ-a̤, Italy, a district of ancient Italy, southeast of Cambria and bordering on the Gulf of Tarentum, corresponding nearly to the present province of Potenza and the eastern part of Salerno. The region was almost wholly occupied by the Apennines, and covered with extensive forests. The Chones and the Œnotrians were the ancient people of this section; but before the introduction of Christianity into Italy, they had been nearly destroyed. Lucania became Roman territory about 300 B.C.

LUCAS, Albert Pike, American painter and sculptor: b. Jersey City, N. J., 1860? He was educated at the École des Beaux-Arts, Paris, under Hébert and Boulanger 1882–88, and subsequently was a pupil of Gustave Courtois and Dagnan Bouveret. Since 1889 he has exhibited regularly at the Paris Salon, also at leading expositions. He was awarded a medal at the Buffalo Exposition of 1901 and received an honorable mention at the Paris Exposition of 1900. Mr. Lucas has painted portraits of many prominent persons and is represented in the National Gallery, Washington, and by a marble bust, 'Ecstasy' in the Metropolitan Museum of Art, New York. Among his paintings are 'The Golden Madonna'; 'October Breezes'; 'Little Church on the Hill'; 'Walking against the Wind.'

LUCAS, Captain Lord (AUBERON THOMAS HERBERT), English statesman and soldier: b. 1876; d. November 1916. He lost a leg in the South African War while acting as correspondent of *The Times.* He afterward held various official posts — Under-Secretary at the War Office, Under-Secretary for the Colonies, and parliamentary secretary to the Board of Agriculture, entering the Cabinet as president of that board in 1914. On the formation of the coalition government in 1915 he abandoned politics and, notwithstanding his physical disability and the fact that he was much over the regulation age, joined the Royal Flying Corps and quickly gained his pilot's certificate. He first served in Egypt, flying over the Turkish lines; after instructing recruits for some months in England he was sent to the western front. On 4 November he made a flight over the German lines and failed to return. His death was reported in December. The barony of Lucas dates from 1663.

LUCAS, Edward Verrall, English author: b. 12 June 1868. He was educated at University College, was connected with the London *Globe* 1893–1900, and with the *Academy* 1896–1901. He published a populer 'Book of Verses for Children' (1897), as well as other works for young readers, and then began an association with *Punch.* Biographer, essayist anthologist, editor, traveler, he brings to all his work sympathy, uncommon powers of observation and description, and a genial, kindly humor. His works include 'The Open Road' (1899); 'Highways and Byways in Sussex' (1904); 'A Wanderer in Holland' (1905); 'A Wanderer in London' (1906); 'Character and Comedy' (1907); 'Over Bemerton's' (1908); 'A Wanderer in Paris' (1909); 'Old Lamps for New' (1911); 'A Wanderer in Florence' (1912); 'Loiterer's Harvest' (1913); 'A Wanderer in Venice' (1914); 'Landmarks' (1914). He has edited a notable edition of the works of Charles and Mary Lamb.

LUCAS, Frederic Augustus, American museum director: b. Plymouth, Mass., 25 March 1852. He was educated in the public schools and from 1871 to 1882 was assistant at Ward's Natural Science Establishment, Rochester, N. Y. From 1882 to 1904 he was successively osteologist, assistant curator of the division of comparative anatomy and curator of the United States National Museum. In 1904–11 he was curator-in-chief of the museums of the Brooklyn Institute of Arts and Sciences and in the latter year was made director of the American Museum of Natural History. Dr. Lucas was member of the commission appointed to investigate the condition of the fur seal herd of the Pribilof Islands. He has written various papers on the anatomy of birds, fossil vertebrates and museum methods and the volumes 'Animals of the Past' (1901); 'Animals before Man in North America' (1902).

LUCAS, George J., American clergyman: b. Youghal, County Cork, Ireland, 22 May 1852. He was educated at Saint Francis Xavier's College, New York City, Woodstock College, Saint Mary's Seminary, Baltimore, the Catholic University of America, Washington and the Pontificial University, Rome. Further studies were made in Canada, England and Belgium. He entered the Society of Jesus, but left it because of his poor health. In 1889 he was ordained to the priesthood and from 1889 to 1896 was curate successively at Scranton, Archbald and Dunmore, Pa. In 1896–1908 Father Lucas was rector of Saint Andrew's Church, Blossburg, Pa.; from 1908 to 1912 of Saint Mary's, Pittston, and after 1912 permanent rector of Saint Patrick's Church, Scranton. Father Lucas is synodal examiner of the diocese of Scranton. He contributed to 'The Catholic Encyclopedia' and is the author of 'Agnosticism and Religion' (1895), which drew a commendatory letter from the Right Hon. W. E. Gladstone, one-time Prime Minister of England. The book is a refutation of the doctrines of agnosticism propounded by Herbert Spencer in his synthetic philosophy and is considered the standard work on agnosticism from the Christian viewpoint in both continents. In March 1919 the Gladstone autograph letter to Dr. Lucas was placed in the collection of Vatican documents exposed for public view in the exhibition cases of the Vatican library.

LUCAS, John Seymour, English artist: b. London, 21 Dec. 1849. He studied with the woodcarver Gerard Robinson; and painting at the Royal Academy; first exhibited at the Academy in 1872; first made his mark by his 'By Hook or Crook,' shown at Burlington House in 1875; and obtained recognition for the high technical excellence of his work. He became a Royal Academician in 1898. Among his later canvases are 'Fleeced'; 'For the King and the Cause'; 'Intercepted Despatches'; 'Charles Before Gloucester'; 'After Culloden'; 'The Call to Arms.'

LUCBÁN, look-bän', or **LUGBANG,** loog-bäng', Philippines, pueblo of the province of Tayabas, Luzon, eight miles northwest of Tayabas, the provincial capital. It is in the heart of a mountainous region, and in the surrounding country rice is grown on *Sawas* or terraces on the hillsides. It is on the main road, and has a profitable trade. The chief industries are the weaving of fine straw hats from the fibre of the buri palmleaf, and the manufacture of pandanus mats. Pop. 10,227.

LUCCA, look'kä (originally LUCAS), **Pauline**, Austrian opera singer: b. Vienna, 24 April 1841; d. there, 28 Feb. 1908. She was a pupil of Uschmann and Lewy, but being too poor to pursue her studies joined the chorus of the Vienna Court Opera. She made her first appearance in opera in 1859 as Elvira in Verdi's 'Ernani' at Olmütz; at once attained great success on the Continent; and later sang in London (1863–65) and New York (September 1872). From 1874 to 1889 she was a member of the Vienna Opera. Illness impaired her voice and in 1889 she retired. Among her chief parts were those of Margeurite, in 'Faust'; Cherubino, in 'Le Nozze di Figaro,' and Zerlina in 'Fra Diavolo.' Auber was so struck by her appearance as Zerlina that he gave her the pen with which he had written the opera.

LUCCA, Italy, the capital of the province of Lucca, and former capital of the ancient Tuscan republic and duchy of Lucca at the base of the Apennines, near the left bank of the Serchio, 37 miles by rail northwest of Florence, and 26 miles from the Mediterranean. Encircled by walls flanked with bastions, it stands in a fertile plain surrounded by the Apennines, and has a striking appearance. It is entered by four gates and is well built. Lucca is an archiepiscopal see, and the seat of several important courts and public offices. It contains numerous antiquities; one of the most interesting is the fish-market, the large oval of which is the Roman amphitheatre; while the buildings around it, though converted into modern dwellings, are in a great measure composed of the ruins of the amphitheatre, and exhibit huge solid arches, and masses of brick and stone, on their original sites. The principal edifices are the *Duomo*, or cathedral (begun 1204), with a magnificent façade, a Romanesque portico, stained glass of the richest kind and a famous life-size crucifix, carved, according to legend, by Nicodemus, and which is only exhibited four times a year; the church of San Michele (8th century), an ancient and imposing structure; the church of San Frediano, founded in 686, furnishing an interesting specimen of early Christian architecture, and adorned with fine mosaics, frescoes, and paintings; the ducal palace; academies of science; public library with over 220,000 volumes; the Palazzo Borghi, now converted into a poor-house; and an aqueduct, carried from a distance into the city over 459 arches. The manufactures consist chiefly of silk goods; and there are numerous silk mills; near by are extensive jute mills. The trade is almost confined to the above articles of manufacture, agricultural produce and olive-oil, particularly the latter, which bears a high name, and is largely exported.

First an Etruscan, then a Ligurian, town Lucca 177 B.C., became a Roman colony. It became a episcopal see in 347. It followed the varied fortunes of northern Italy until about 1115 it was made the seat of a republic. In 1320 it fell under the dominion of Castruccio Castracani, who became Duke of Lucca, and after his death Lucca was sold to Florence. It purchased its liberty from Charles IV in 1369, and maintained its independence until the French occupation in 1799. In 1814 the Congress of Vienna recreated it a duchy. In 1847 it was reunited to Tuscany, and it became part of the kingdom of Italy in 1860. Pop. about 76,160.

The Bagni di Lucca, situated north of the city in the valley of the Lima, a tributary of the Serchio,, is celebrated for its warm springs and baths, with temperatures ranging from 98° to 130° F.

Consult Del Carlo, 'Storia popolare di Lucca' (2 vols., Lucca 1877); and Ross and Erichsen, 'The Story of Lucca' (in 'Mediæval Town Series,' New York 1912).

LUCCOCK, George Naphtali, American clergyman: b. Kimbolton, Guernsey County, Ohio, 31 March 1857. In 1878 he was graduated at the University of Wooster and in 1881 at the Western Theological Seminary. In the latter year he was ordained to the Presbyterian ministry and for 10 years was engaged in home missionary work in Kossuth, Emmett, Dickinson and Greene counties, Iowa, and Westminster Church, Des Moines. In 1891–94 he was pastor at Bloomington, Ind., in 1894–1903 at Washington, D. C., in 1903–17 at Oak Park, Ill., and at the College Church, Wooster, Ohio, since February 1917. In 1910 Dr. Lucas was a delegate to the World's Missionary Conference at Edinburgh and is member of the commission of the general assembly charged with the preparation of a new Intermediate Catechism. He is the author of 'Christianity and War' (1917).

LUCE, Auguste Siméon, French historian: b. Bretteville-sur-Ay, Manche, 1833; d. 1892. He received his education at the École des Chartes in 1856–58. In 1858 he was appointed archivist of the department of Deux-Sèvres and eight years later was made chief of the historical division of the National Archives. In 1882 M. Luce was elected member of the Academie de Inscriptions et Belles Lettres. In the same year he was appointed to the chair of historical sources of French history at the École des Chartes and in 1883 received the cross of the Legion of Honor. His publications include an edition of Froissart (1866–88) and 'Le chronique du Mont-Saint-Michel' (1879–86); 'De Gaidone poemate Gallico Vetustiore Disquisitio Critica' (1860); 'Chroniques des quatre premiers Valois' (1862); 'Histoire de Bertrand Duguesclin et de son époque' (1876; 2d ed., 1883); 'Jeanne d'Arc à Domrémy' (1886); 'La France pendant la guerre de Cent Ans' (1890).

LUCE, Stephen Bleecker, American naval officer: b. Albany, N. Y., 25 March 1827; d. Newport, R. I., 28 July 1917. He was appointed midshipman from New York in 1841; saw service in various waters and made the circuit of the globe; during the Mexican War was on the Pacific Coast; and in the Civil War was commander of the monitor *Nantucket*, and of the *Sonoma*, *Canandaigua* and *Pontiac*. He revived the naval apprentice system and later established it at Newport, R. I. He founded the Naval War College and was its first president, and in 1886–89 was in command of the North Atlantic station. On 25 March 1889 he was retired. He was an associate editor of the 'Standard Dictionary,' and author of 'Seamanship' (1863–98), 'Naval Songs' (1889) and 'The Patriotic and Naval Songster.'

LUCENA, loo-thä'nä, Spain, an Andalusian city in the province of Cordova, 37 miles southeast of that city, in a picturesque hilly situation. It is well built, has a fine parish church, schools, benevolent institutions, a town-house, a magnificent «paseo» or public promenade, and in the neighborhood are medicinal baths of repute. It manufactures linens, shoes, earthenware, glass, iron, copper and other metallic vessels, oil, vinegar, brandy, and is in a region noted for its wines, and for horse-raising. Pop. 21,029.

LUCERNE, lū-sėrn', (Fr. lü-sãrné), Switzerland, the capital of the canton of Lucerne, and one of the three seats of the Swiss Diet, on an acclivity at the northwest end of Lake Lucerne. The Reuss, which issues from the lake and flows through the town, is crossed by five bridges, two of which are covered and ornamented with curious mediæval paintings, including a Danse Macabre. The town retains its feudal walls and watch-towers, and with the neighboring mountains, including the Pilatus and Rigi, is noted for its picturesque features and scenic beauties, making it a much-frequented tourist centre. Lucerne is well-built, has regular, clean streets, electrically lighted and traversed by street railroads, a town-hall, with valuable stained glass of the 14th century, Jesuit college, now the government building; a 15th century parish church, with two slender towers; a Gothic Protestant church; Ursuline convent, with handsome church; a museum and cantonal library of 90,000 volumes; large town hospital, poorhouse, deanery, arsenal, a new International Museum of War and Peace, mint, casino, etc.; and besides the college or lyceum, several well-conducted educational establishments. The water supply is obtained from springs on Mount Pilatus, 14 miles off. An interesting monument is the 'Lion of Lucerne,' designed by Thorwaldsen, in memory of the Swiss guards who fell in Paris in 1792 while defending the Tuileries, and hewn out of the solid rock. Lucerne has some transit trade, but the manufactures are unimportant; it depends chiefly on the important tourist traffic, accommodating annually 250,000 visitors. Pop. about 41,500. Lucerne was founded in A.D. 750. It was at one time under the Austrian yoke; but it has belonged to the Swiss Confederation since 1332. During the Reformation period it was a stronghold of Catholicism, and such it has remained. Under the Helvetic Republic it was the seat of the central government, and it led in the Sonderbund War, but was captured by the Federals in 1847.

LUCERNE, also called **PURPLE MEDICK,** a leguminous forage plant (*Medicago sativa*); native to Europe, and extensively grown there, in the United States and other countries of the temperate and semi-tropical zones. It is of the natural order Leguminosæ, and is often found in a wild state in Europe and western Asia. Lucerne has a well-developed tap-root, often three-fourths of an inch in diameter in old plants, with strong lateral roots which descend to a depth of several feet, where the subsoil is open and adapted to the growth of the plant. From the root-stock, which is perennial, many upright stems are sent up to a height of one to three feet, bearing trifoliate leaves, the leaflets of which are somewhat narrow, obovate, with dentate margins and projecting tips to the midribs. The flowers, which grow in racemes or clusters, are generally purple, though plants with pale yellow flowers are met with occasionally. The pod is a spirally coiled legume containing several greenish-yellow seeds about the size of those of red clover. Seed does not usually ripen well in Great Britain and in Europe the best comes from southern France. When fully established lucerne is one of the most valuable of all farm crops, yielding a highly nutritive green fodder. Since it rapidly deteriorates in feeding value when the flowering period commences, it should be cut just before the bloom appears. In America it is very generally known by the Spanish name of alfalfa (q.v.). Hardy Siberian species are now being introduced in the Northern States and in Canada.

LUCERNE, Lake of, or **VIER-WALDSTÄTTERSEE** (Lake of the Four Forest Cantons), Switzerland, the largest, and in many respects the most magnificent, Swiss lake, near the centre of the country, 1,433 feet above sea-level, surrounded by the cantons of Lucerne, Schwyz, Uri and Unterwalden; area, 49 square miles. It is irregular in shape and divided into reaches, separated by narrow straits, giving it the appearance of three distinct lakes. The extreme length from west to south through its centre is 23¼ miles; greatest breadth a little over two miles; while the depth varies from 300 to 702 feet. It presents every variety of lake scenery. In the upper reach, lofty mountain masses, including Pilatus and the Rigi, tower above the lake, and descend in sheer precipices to its very edge. It never freezes over. Owing to the violent storms which suddenly burst over the lake, its navigation is dangerous. Steamers ply regularly upon it. The Reuss River enters the lake at Flüelen and flows out of it at Lucerne. Cut out of the solid rock on the eastern shore is the Axenstrasse, one of the most beautiful of lakeshore roads. At Brunnen the league was made (1307) that achieved Swiss independence; and there are interesting traditional memorials of William Tell. Over 20 pleasure steamers ply the lake, carrying annually over 2,000,000 passengers.

LUCHAIRE, Achille, ă-shēl lü-shār, French historian: b. Paris, 24 Oct. 1846; d. 14 Nov. 1908. He was professor in the Bordeaux faculty of letters; was made a professor at Paris, where in 1889 he obtained the chair of mediæval history. In addition to studies of the Basque language, such as 'Noms de lieux du pays basque' (1872), and 'De lingua aquitanica' (1877), he published a comprehensive work on the Gascon dialects, 'Etudes sur les Idiomes pyrénéens de la Région française' (1879), crowned by the Academy, and a number of historical narratives, such as 'Institutions monarchiques de la Fance sous les premiers Capétiens' (1884), and 'Les communes françases à l'époque des Capétiens directs' (1890); 'L'Université de Paris sous Philippe-Auguste' (1899); an exhaustive history of the Papacy in the time of Innocent III in six volumes (1904–08); Social, 'France at the Time of Philip Augustus' (Eng. trans., 1912). Consult Imbert de la Tour, 'Achille Luchaire' in *Revue des Deux Mondes* (Vol. LII, 1909).

LUCIA DI LAMMERMOOR, loo-chē'a dēlă'mėr-moor, a tragic opera by Gaëtano Donizetti; text by Salvatore Cammerano. First performed in Naples on 26 Sept. 1835. Though based on Walter Scott's romance, ‘The Bride of Lammermoor,’ the opera differs from the book and its English characteristics have been given an Italian atmosphere. Of the 64 operas composed by Donizetti the ‘Lucia di Lammermoor’ — his masterpiece — and two others, ‘Lucrezia Borgia’ and ‘The Daughter of the Regiment,’ are about the only ones ever performed nowadays. In the story Lucia, sister of Henry Ashton, Lord of Lammermoor, is in love with Sir Edgardo of Ravenswood, her brother's mortal enemy. Although Lord Ashton had slain Edgardo's father and burnt his castle, Edgardo is willing to forego his vengeance for the love of Lucia. The lovers swear eternal fidelity to each other and Edgardo departs for France on service. During his absence Lord Ashton shows his sister a forged document purporting to show that her lover has broken faith. Much against her will she agrees to marry Arthur, Lord Bucklaw, a wealthy suitor chosen by her brother. The wedding takes place, when Edgardo arrives at the end of the ceremony — too late. Lucia loses her reason and kills her husband; Edgardo, desiring to see her once more, arrives to find her dead. He stabs himself and prays to meet his bride in heaven.

LUCIAN, lū'shĭ-an, Greek author: b. Samosata, Syria, about 125 A.D.; d. Egypt toward the close of the 2d century A.D. He went to Antioch and devoted himself first to law and afterward to rhetoric, and traveled in several countries (among others, Greece, Italy, Spain and Gaul) as a professional orator. On returning home, probably about his 40th year, he abandoned the profession of rhetoric, which he seems partially to have resumed in his old age, and confined himself to philosophy and literature. He lived to an advanced age, and was at a late period of his life made procurator of part of Egypt. The works of Lucian, of which many have come down to us, are narrative, rhetorical, critical, satirical, mostly in the form of dialogues. The most popular are those specifically known as the ‘Dialogues,’ in which he derides the popular mythology and the philosophical secrets, particularly his ‘Dialogues of the Gods’ and ‘Of the Dead.’ These have given him the character of the wittiest of ancient writers. He seems not to belong to any system, attacks imposture and superstition freely and boldly where he finds them, but is devoid of inspiration. The Epicureans, who in this respect agree with him, are therefore treated with more forbearance. The Christian religion, of which, however, he knew little, and that only through the medium of mysticism, was an object of his ridicule. His writings were once largely studied as textbooks, but his diction is not of the best. (See DIALOGUES OF THE DEAD). Among editions of his works may be mentioned Lehman's (1822–29), F. Fritsch's (1882–85), incomplete; and Sommerbrodt's (1886–99), and Fowler's (4 vols., 1905). The most complete English translation is by Howard Williams (1888, in Bohn's series), and there are also renderings by Francklin (1781) and Tooke. Consult Allinson, ‘Saint Lucian: Selected Writings’ (Boston 1905); Croiset, ‘Essai sur la vie et les œuvres de Lucien’ (Paris 1882); Harmon, in ‘Loeb Classical Library’ (Vol. I text and translation, New York 1913); Hine, ‘Lucian the Syrian Satirist’ (ib. 1900).

LUCIFER. Of Vondel's voluminous works the favorite with the Dutch is ‘Gysbrecht van Amstel,’ but ‘Lucifer’ (1654) has a more universal interest because of its startling subject matter, which combines the naiveté of the mediæval religious play with ultramodern boldness of thought. Lucifer, the Stadholder of God, fearing the subjection of the archangels under man as a result of the Incarnation, revolts and is defeated. From revenge he tempts man and is plunged with all his hosts into eternal perdition where he loses his original beauty to become the monster of popular tradition. The Catholic poet's dedication to Emperor Ferdinand III who «like Divine Majesty is seated in unapproachable light,» along with his political pasquinades, cause his drama to seem a political allegory rather than a religious play. In his preface to the printed work he claims he was «the more eager to bring Lucifer upon the tragic stage since he stricken at last by the thunderbolt of God is thrust down to Hell as a signal example to all thankless and ambitious persons who audaciously dare to rise up against consecrated powers and majesties and lawful authorities.» The pasquinade «To the Regicides» and «Protector Werewolf» make of Cromwell the «dissembling Lucifer» who wrested the sword from his sovereign in order to raise the Hellish Host to the Engelsch-English or angels' throne. Vondel's political satire, the drama ‘Pœlamedes,’ nearly cost him his head in 1625. Since this includes Prince Moritz of Orange in its targets, it is not impossible that King Philip's Stadholder William of Orange is also the original of ‘Lucifer.’

The drama was produced at Amsterdam on 2 and 5 Feb. 1654, and withdrawn in answer to the vehement protests of the Calvinistic clergy. It was printed in 1654 and 1661, but not once during the 18th century, though more than 20 editions appeared in the 19th. It is written in Alexandrines in powerful and picturesque language often of Miltonic grandeur, but it lacks true dramatic quality, since all action of importance is narrated, not presented.

George Edmundson has proved the indebtedness of Milton to «Lucifer» for his ‘Paradise Lost,’ the English poet stressing the fall of man, Vondel, the revolt of the angels. Edition: Vondel's ‘Werken,’ J. van Lennep (Vol. XVII, Leiden 1894); Vondel's ‘Treurspelen,’ J. van Vloten (Vol. I, Historical Introduction, Schiedam 1875); Eng. trans., C. L. van Noppen (New York 1898); ‘Milton and Vondel,’ George Edmundson (London 1885).

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LUCIFER, lū'sĭ-fėr, (1) in ancient astronomy, the morning star. A name given to the planet Venus when she appears in the morning before sunrise. When Venus follows the sun, or appears in the evening, she is called Hesperus, the evening star. (2) A name commonly given to Satan, the prince of darkness, due to the Fathers of the Church having misinterpreted the reference to Lucifer (the king of Babylon) in Isaiah xiv, 12 as being to Satan. (3) A term originally applied to matches tipped with a mixture of chlorate of potash and sulphuret of antimony, which were inflamed by friction on a piece of emery paper. These have been superseded by a variety of mixtures containing phosphorus.

LUCIIDÆ, lū-sĭ'i-dē, or **ESOCIDÆ,** the pike and pickerel family of bony fishes. These fishes have an elongated, somewhat compressed, powerful body, with rather small cycloid scales, an imperfect lateral line; the head and snout prolonged and depressed, the mouth large and lower jaw longest. The mouth is filled with strong teeth, and these fishes are the fiercest carnivores of the fresh waters. The family is widely distributed in northern waters, and may be traced back to the Miocene Age. See PIKE.

LUCILE, lū-sēl', an epic poem by LORD Lytton. (Owen Meredith), published in 1860. The narrative was founded upon the French novel 'Lavinia' by George Sand.

LUCILIUS, lū-sĭl'ĭ-ŭs, **Gaius,** Roman author: b. Suessa, 180 B.C.; d. Naples, 103 B.C. He was grand-uncle to Pompey the Great on the maternal side. He served his first campaign against Numantia under Scipio Africanus, with whom he was very intimate. He is considered the inventor of the Roman *satira,* because he first gave it the form under which this kind of poetry was carried to perfection by Horace, Juvenal and Persius. His satires were superior, indeed, to the rude productions of Ennius and Pacuvius, but he in turn was surpassed by those who followed him. Horace compares him to a river which carries along precious dust mixed with useless rubbish. Of 30 books of satires which he wrote only 940 fragments have been preserved. In his lifetime these satires had an uncommon popularity. Consult the edition by Lachmann and Vahlen (1876); Müller, 'Leben und Werke des Gaius Lucilius' (1876); Marx (2 vols., Leipzig 1904–05); Cichorius, 'Untersuchungen zu Lucilius' (Berlin 1908); and for criticism of these two later editions Knapp, C. (in *American Journal of Philology,* Vol. XXIX, New York 1908).

LUCIN CUT-OFF. A famous link in the Southern Pacific Railroad Overland route completed in 1903 across the centre of Great Salt Lake west of Ogden, Utah. At Lucin it joins the old line which circles far to the north around the head of the lake and climbs over several high ridges, one 680 feet high. It cuts off 44 miles and the new line is practically level for 72 miles. It consists partly of rock fill and about 12 miles of trestles.

LUCINA, lū-sī'na, in Roman mythology, the goddess of light, a surname of Juno (according to some of Diana; according to others the name of a daughter of Jupiter and Juno) derived from the root of *luceo* (I shine). Her festival was celebrated 1 March, on which occasion the matrons assembled in her temple, adorned it with flowers and implored a happy and brave posterity.

LUCIUS, lū'shĭ-ŭs, the name of three popes, as follows:

LUCIUS I: d. March 254. He succeeded Pope Cornelius on 23 June and by some authorities is said to have suffered martyrdom under Gallus, but this cannot be proved.

LUCIUS II (GHERARDO CACCIANEMICI, gā-rär'dō kä"chē-ä-nä-mē'chē): d. 15 Feb. 1145. He was legate to Germany from Honorius II, supported Innocent II against the antipope, Anacletus II, and became chancellor of the Holy See. In 1144 he succeeded Celestine II, but was unsuccessful in quelling revolts against the papal authority in Rome and while heading his troops to suppress a disturbance, was killed by a paving stone thrown from the mob.

LUCIUS III (UBALDO ALLUCINGOLI, oo-bäl'do äl-loo-chēn'gō-lē); d. Verona, 25 Nov. 1185. He was the cardinal-bishop of Ostia and became Pope 1 Sept. 1181. He was the first Pope elected solely by the cardinals. The Emperor Frederick Barbarossa having claimed the estates bequeathed to the papacy by Matilda of Tuscany, Lucius demanded their surrender. Frederick refused and the quarrel ended in the expulsion of Lucius from Rome. He died an exile in Verona.

LUCK OF EDENHALL, The. See EDENHALL.

LUCK OF ROARING CAMP, The, a celebrated short story of California mining life written by F. Bret Harte (q.v.), which was first published in the *Overland Monthly* in 1869. The story attracted attention in the East and appeared in book form the following year. It is perhaps the most notable of the many short stories of Western life written by this author.

LUCKENWALDE, lŭk'ĕn-väl'dĕ, Prussia, town in the province of Brandenburg, situated on the Nuthe, 30 miles south of Berlin, on the Berlin-Dresden-Leipzig Railroad. It is an important industrial centre, its establishments including cloth and woolen manufactories, cotton, printing and dye works, metal and bronze works, foundries, machine shops, hat factories, paper, piano and cardboard factories, etc. Pop. 23,500.

LUCKNOW, India, former capital of Oudh, 666 miles northwest of Calcutta and 885 miles from Bombay. It is situated on both banks of the Gumti, and is connected by the Oudh and Rohlkund line with the general Indian railway system. The cantonment is in the southeast corner of the city. Lucknow has an imposing appearance at a distance which a nearer view fails to realize, but it has some beautiful open spaces, and has been called the «City of Parks.» The principal buildings are the Kaiserbagh Palace, built in 1850, now occupied as government offices and forming a gorgeous pile of domes, pinnacles, terraces and fountains; the Imâmbara or holy palace, where Asuf ud Douelah is buried, now an arsenal; the great mosque or Jama Masjid; and the Hoseinalad or small Imâmbara with the mausoleum of Mohammed Ali. The Martinière College for half-caste children is a striking building founded by Claude Martin, a French soldier who became a general in the East India Company. Other educational institutions include Canning College, Colvin College and the Reid Christian College of the American Methodist Mission, which has also established a high school for girls. Its chief manufactures are of cotton, and chikan or embroidery in silk or cotton on muslin; also brass and copper work, wood carving, pottery, paper making, printing, shoemaking and tobacco stripping, and there are extensive railway workshops. A municipality was organized in 1864.

Lucknow was founded by Lakshmana, brother of Rama Chandra. After the Mohammedan conquest it was occupied by Shaiks and Pathans. It rose to its highest splendor as the capital of the kingdom of Oudh, established during the decay of the Mogul Empire; but a selfish and sensual race of rulers imposed heavy burdens on the people; and the country fell under British control in 1856. Lucknow is associated with some of the most stirring incidents in the Indian Mutiny (q.v.), when 1,200 men held out against 10,000 mutineers until relief came through re-enforcements brought by Havelock and Outram. The residency, the Secunder Bagh and the Alumbagh, where Havelock is buried, are interesting memorials of the siege. Pop. about 259,798. Consult Innes, 'Lucknow and Oudh in the Mutiny' (1905).

Lucknow also gives its name to a division of the United Provinces as well as to a district and *tahsil.* The division is the westernmost of Oudh, and it lies between the Ganges on the southwest and the Gogra on the northeast, and contains six districts. Area, 12,051 square miles. Pop. about 5,911,642. In 1901 87 per cent of the population were Hindus and 13 per cent Mohammedans. The district is the smallest in the United Provinces, and comprises three *tahsils.* Area, 967 square miles. Pop. about 764,411. In 1901 78 per cent were Hindus and over 20 Mohammedans. The *tahsil,* in which the city of Lucknow is situated, has an area of 360 square miles.

LUCKOCK, Herbert Mortimer, English clergyman: b. Great Barr, Staffordshire, 11 July 1833; d. Lichfield, 24 March 1909. He graduated from Jesus College, Cambridge, was twice vicar of All Saints, Cambridge, and was rector of Gayhurst with Stoke-Goldington. Subsequently he was residentiary canon of Ely and principal of the Ely Theological College, and in 1892 became dean of Lichfield. Among his writings are 'Tables of Stone'; 'After Death'; 'Footprints of the Apostles,' and Characteristics of the Four Gospels.'

LUCRETIA, lū-krē'shĭ-ạ, Roman matron of distinguished virtue, whose ill-treatment by Sextus Tarquin led to the destruction of the kingdom, and the formation of the republic of Rome. She was the wife of Collatinus, near relation of Tarquin, king of Rome. Sextus Tarquinius, who contrived to become a guest in the absence of her husband, whose kinsman he was, found means to reach her chamber in the middle of the night, and threatened, unless she gratified his desires, to stab her, kill a slave, place him by her side and then swear that he had slain them both in the act of adultery. The fear of infamy succeeded. She afterward summoned her husband, father and kindred, and after acquainting them with the affair stabbed herself to the heart. The story has been variously adapted by poets and romancers.

LUCRETIUS, lū-krē'shĭ-ŭs, **Carus Titus,** Roman author: b. probably 97 B.C.; d. 53 B.C. About his life almost nothing is known. He is supposed to have studied Epicurean philosophy at Athens. He is said to have been made insane by a philtre, in his lucid intervals to have produced several works, and to have committed suicide in his 44th year. We possess of his composition a didactic poem, in six books, the 'De Rerum Natura,' in which he exhibits the cosmical principles of the Epicurean philosophy with an original imagination, and in forcible language. The work is in six books, revised by Cicero, and is entire but, evidently, not complete. The theory of corpuscles and their properties; the origin of the vital and intellectual principles; of the senses; of the world and the movements of the heavenly bodies; of the rise and progress of society; and of arts and sciences, with other expositions of natural phenomena, are successively treated. Lucretius purpose was to free his readers from the fear of death which he believed to be bound up with the superstitions of the popular religion. As a work of art his poem has received the unanimous praise of critics for the skill with which the most unyielding materials are reduced to a poetic diction full of life and sustained majesty. It has influenced the foremost English poets. (See DE RERUM NATURA). Consult Giussani, C., 'Note lucreziane' (Turin 1900); Masson, John, 'Lucretius: Epicurean and Poet' (2 vols., London 1907–09); Mallock, W. H., 'Lucretius on Life and Death' (ib. 1900); Wallace, W., 'Epicureanism' (ib. 1880); Zeller, E., 'Stoics, Epicureans and Sceptics' (ib. 1880).

LUCULLUS, lū-kŭl'ŭs, **Lucius Licinius,** Roman soldier of the 1st century B.C. When a young man he served with distinction in the Marsic War, and accompanied Sulla as quæstor into Asia on the breaking out of the Mithridatic War, 88 B.C. He expelled Mithridates from Chios and Colophon and defeated him off Tenedos. After peace had been concluded with Mithridates he remained in Asia till 80 B.C. In 79 he was elected curule ædile, an office which he held in conjunction with his younger brother. Subsequently he held the office of prætor. On the conclusion of this magistracy he went to Africa, the administration of which province he conducted with ability and impartiality, and in 74 B.C. obtained the consulship with M. Aurelius Cotta. As consul he maintained the constitutional laws of Sulla. On the breaking out of the war with Mithridates he obtained the proconsulship of Cilicia and the command of the army. He vanquished the squadron of Mithridates near the island of Lemnos, and this victory enabled him to drive all the other squadrons of Mithridates from the Archipelago. The generals of Lucullus subdued meanwhile all Bithynia and Paphlagonia. Lucullus, again at the head of his army, although overcome by Mithridates in a battle, soon acquired such advantages that he finally broke up the hostile army, and Mithridates himself sought protection in Armenia. Lucullus now changed Pontus into a Roman province. Tigranes, king of Armenia, refusing to surrender Mithridates to the Romans, Lucullus marched against Armenia and vanquished Tigranes 69–68 B.C. Mithridates, however, contended with varying fortune, till Lucullus was prevented from effectively continuing the war by the mutiny of his soldiers. Lucullus was deprived of the chief command, which was bestowed first on Glabrio, and afterward on Pompey, and recalled 66 B.C. After a delay of three years he succeeded in procuring the merited recognition of his services in a public triumph. He laid out his gardens at Rome with such splendor that they became proverbial, and Pompey called him the Roman Xerxes.

LUCY, SIR Henry (William), English journalist: b. Crosby, near Liverpool, 5 Dec.

1845. He was for a time a member of the Shrewsbury *Chronicle* staff; in 1870–73 was connected with the *Pall Mall Gazette* (morning edition); and from 1873 with the *Daily News*, of which — with the exception of the period January 1886–July 1887, when he was editor-in-chief — he was the Parliamentary correspondent. He visited the United States in 1883, on his way around the world; an account of which journey appeared in the New York *Tribune* in the form of letters, subsequently collected as ‘East by West’ (1885). On the death of Tom Taylor (q.v.) Lucy continued the former's ‘Essence of Parliament’ in *Punch* as ‘The Diary of Toby, M. P.,’ and as such has proved himself a racy and entertaining writer on British public men. Among his books are ‘Men and Manners in Parliament’ (1874); ‘A Diary of Two Parliaments’ (1885–86), and on the same lines the diaries of the Salisbury, Home Rule, Unionist and Balfourian parliaments (1892, 1895, 1901, 1906). ‘Memories of Eight Parliaments’ (1908); ‘Sixty Years in the Wilderness’ (1909, 1912) and ‘Nearing Jordan’ (third series, 1916), are his most recent works. He was knighted in 1909.

LUCY, Sir Thomas, English landed proprietor: b. 1532; d. Charlecote, 7 July 1600. He was educated by John Foxe (q.v.), the martyrologist; and he followed the Puritan sentiments of his tutor. In 1552 he came into possession of great estates in Warwickshire, in 1558–59 rebuilt the manor-house, which still exists, an excellent specimen of the Tudor style. He was knighted in 1565, and elected M.P. for Warwick in 1571 and 1584. His chief interest is in his alleged connection with Shakespeare (q.v.) whom he is said, in a story dating from the 17th century, to have prosecuted for deer-stealing. This story is now thought to be based on fact, though burdened with false details; and Shakespeare is believed undoubtedly to satirize him as Justice Shallow in ‘The Merry Wives of Windsor.’ Consult Lee Sir Sidney, ‘Life of Shakespeare.’

LUDDITES, in British history a name given to rioters in 1811–16, in Yorkshire, Lancashire and Nottinghamshire, in England, who attributed the prevailing distress to the introduction of machinery in manufactures, and did a great deal of damage in destroying it. For a time these counties were in a perpetual state of disturbance, but on the return of prosperity the riots ceased.

LUDENDORFF, General Von, German soldier: b. Posen, Prussia, 1865. He passed out of the War Academy in 1895 and was soon afterward appointed to the Great General Staff in Berlin, where his high mental attainments won him recognition and rapid advancement. A born soldier, strong-willed, endowed with an iron constitution and obsessed with but one idea — the perfection of the great fighting machine of which he was a part — Ludendorff became by far the most dominant figure produced on the German side during the war. At the end of 1912 he was chief of a department at the General Staff with the rank of colonel; in April 1914 he was promoted to major-general and placed in command of an infantry brigade at Strassburg. He was given another command shortly after the outbreak of war, but before the war was a month old he was sent to East Prussia as chief of staff of the 8th army under Hindenburg. The impression prevailed that Ludendorff was responsible for the recall of Hindenburg from his retirement to command the 8th army operating against the Russian invasion, and that Hindenburg had returned the compliment by asking for Ludendorff as his chief of staff. From this stage the two men worked together and it would be difficult to assert how much the chief of staff contributed to Hindenburg's successes and made him for a time the idol of the German people. According to some authorities, Ludendorff was the brain and Hindenburg the arm of the German military power. A Russian officer declared in 1915 that Ludendorff had offered him a million francs to procure the murder of the Grand Duke Nicholas and a graduated scale of rewards for the suppression of Russky, Ivanov and Brussilov. The failure of Von Falkenhayn at Verdun in 1916 led to his being superseded by Hindenburg as virtual commander-in-chief, and Ludendorff became first quartermaster-general. It was also alleged that the shuffle of commands was a plot between the Kaiser and Falkenhayn to discredit Hindenburg and lower his enormous popularity by giving him free rein, in the certainty that he would run his head against a wall. A more probable explanation was that if the bitter truth had at last to be told the German people, he alone could perform the task and carry the nation with him. Ludendorff, however, was the principal power — a mysterious personality that gradually overshadowed even the Kaiser. Mr. Gerard, former United States Ambassador to Germany, credits Ludendorff with forcing the break with America, and also with ordering the Belgian deportations. "Many persons in a position to know told me that the real dictator of Germany was Ludendorff." Silently and unobtrusively he matured strategic plans, intrigues and press campaigns in his solitary and closed office, making his calculations and solving his problems. With the collapse of German military power under the great Allied drive, the "German Napoleon," as he was frequently called, fell from his high estate, "a shattered idol lying in the dust." He encouraged the Bolsheviki and bribed them with millions. He dominated not only Germany, but all her allies for a time. When Count Czernin came to tell him that Austria must have peace at any price, Ludendorff threatened the Dual Monarchy with war and invasion. He labored to promote strife in the Reichstag and discord among the Allies. All over Europe his cunning, unscrupulous system spread its tentacles. In November 1918, after the crash, the *National-Zeitung* of Berlin confessed that Ludendorff's malign policy had brought America into the war and caused four-fifths of mankind to feel that it was better to fight to the last man and perish than to witness the triumph of such a combination of dishonor and brutality. Already in August 1918 Ludendorff had launched peace kites and endeavored to persuade the Kaiser of the hopelessness of the struggle; it was he, also, who prompted the request by Germany for an armistice. When the inner history of the war is written on the German side, the diabolical genius of Ludendorff, his rise and his fall, will stand as one of the romantic episodes in the great conflict.

LUDENSCHEID, lü'dĕn-shīd', Prussia, town in Westphalia, 20 miles southeast of Hagen and 32 miles northeast of Cologne. It is a manufacturing town, with cutlery and hardware works, musical instrument factories, watch, umbrella, cane and wire works, iron foundries, cotton-mills, etc. Pop. 32,300.

LUDINGTON, Mich., city, county-seat of Mason County, on Lake Michigan and Marquette River. It is the terminus of the Pere Marquette Railroad, about 85 miles northeast of Milwaukee, Wis., 130 miles northwest of Lansing and 61 miles from Manitowoc on the opposite side of the lake. It has regular steamer communication with the large ports on Lake Michigan and direct freight connection, by ferry, with Manitowoc, Wis. It was settled in 1851, incorporated in 1867 and chartered as a city in 1874. The principal industries are connected with the manufacture and shipment of salt and lumber. There are large lumber mills, game-board factories, watch-case, printers' supplies, furniture and clothes-pin factories. Lumber, grain, flour, salt and fruit are among the articles shipped to outside markets. The city has many guests in the summer months, attracted by the cool climate and opportunities for fishing in the several lakes nearby. The Epworth League Training Assembly has nearby grounds and cottages. There are also a students' military camp, a Carnegie library, a courthouse, a station of the United States Weather Bureau, a clubhouse and park. The waterworks are owned by the city. Pop. 9,969.

LUDLOW, lŭd'lō, **Edmund**, English leader of the Republican party in the civil wars of Charles I and regicide: b. Maiden Bradley, Wiltshire, about 1617; d. Vevay, Switzerland, 1692. He was graduated from Trinity College, Oxford, in 1636; fought at Edgehill in 1642; in 1646 was elected to Parliament from Wiltshire; and in December 1648 was one of the chief promoters of «Pride's purge» (q.v.). He was one of the judges who signed the death-warrant of Charles I, sat in the council of state in 1649–50 and was lieutenant-general of the horse in Ireland and a commissioner for the civil government of that country in 1650–55. In 1656, upon the proclamation of Cromwell as lord protector, he declined to recognize Cromwell's authority, or to give security to keep the peace. Having been allowed to go into retirement in Essex, he was elected to Parliament for Hindon in 1659, and upon the recall of the Long Parliament became a member of the committee of safety (7 May), of the council of state (14 May) and commander-in-chief of the Irish army, with rank of lieutenant-general (4 July). He was impeached upon the Restoration (1660), surrendered, was allowed his liberty on providing sureties and escaped to Switzerland. His 'Memoirs' (1698–99) furnish a good account of the opposition to Cromwell and of the factional troubles which overthrew the republic. Of this work a new edition edited by C. H. Firth appeared in 1894.

LUDLOW, Fitzhugh, American journalist: b. Poughkeepsie, N. Y., 11 Sept. 1836; d. Geneva, Switzerland, 12 Sept. 1870. He was graduated from Union College in 1856, in 1858–59 studied law in New York, in 1859 was admitted to the bar, but from 1860 devoted himself exclusively to literature. In 1860–61 he was connected with the *World* and the *Commercial Advertiser*, for a time was dramatic, art and musical critic of the *Evening Post*, to which he long contributed, and held a similar post as critic on the *Home Journal*. He was also a frequent contributor to *Harper's Monthly* and other magazines. In 1863 he journeyed across the plains to Oregon and California, and in an article styled 'Through Tickets to San Francisco,' laid out a route for a Pacific railroad largely identical with that later followed. He was among the earliest contributors to *Northern Lights* of Boston, upon the establishment of that magazine. Among his works are 'The Hasheesh Eater: Being Passages from the Life of a Pythagorean' (1857); 'Little Brother and Other Genre Pictures' (1867); 'The Opium Habit' (1868); and 'The Heart of the Continent: A Record of Travel' (1870).

LUDLOW, James Meeker, American Presbyterian clergyman and author: b. Elizabeth, N. J., 15 March 1841. He was graduated from Princeton in 1861, from the Princeton Theological Seminary in 1864, entered the Presbyterian ministry and was pastor of the First Presbyterian Church of Albany 1864–68 and of the Collegiate Reformed Church of New York in 1868–77. His subsequent pastorates were that of Westminster Church, Brooklyn, N. Y. (1877–85), and that of the First Presbyterian Church of East Orange, N. J., 1886–1909. In 1885 he declined the presidency of Marietta College (Ohio). Dr. Ludlow received honorary title of D.D. from Williams College, and that of L.H.D. from Princeton University. In 1909 he resigned his pastoral charge in East Orange, becoming by vote of the people pastor emeritus. He has since spent much time in Italy. Dr. Ludlow is a member of New York Authors' Club; American Historical Association; New Jersey Historical Society; Long Island Historical Society; Washington Society of New Jersey and many other social and scholarly organizations. For many years he has been a director of the Union Theological Seminary in New York. He is a frequent contributor to the periodical literature of the day. His works are 'My Saint John' (1883); 'Concentric Chart of History' (1885); 'Captain of the Janizaries,' a tale of Albania (1886); 'A King of Tyre,' a story of ancient Phœnicia (1891); 'That Angelic Woman' (1891); 'History of the Crusades' (1896); 'Baritone's Parish' (1897); 'Deborah,' a story of the time of Judas Maccabeus (1901); 'Incentives for Life' (1902); 'Sir Raoul,' a story of Venice and the Fourth Crusade (1905); 'Jesse Ben David,' a story of the time of Christ (1907); 'Judge West's Opinion,' a study in optimism (1908); 'Discovery of Self,' lectures to young men (1910); 'Avanti!' a story of Sicily in 1860 (1913).

LUDLOW, John Malcolm Forbes, English social reformer and author: b. Nimach, India, 8 March 1821; d. 17 Oct. 1911. He was educated at the College Bourbon, Paris, became a barrister of Lincoln's Inn, London, in 1843, and practised as a conveyancer till 1874. His interests, however, lay mainly outside his profession. Reforms in India and the Anti-Corn law movement deeply interested him, and he was associated with the beginnings of the Christian Socialist and industrial co-operative movements. He was chief registrar of Friendly Societies 1874–91, and has published ‘Letters on the Criminal Code’ (1847); ‘The Master Engineers and Their Workmen’ (1852); ‘British India: Its Races and Its History’ (1852); ‘Thoughts on the Policy of the Crown Toward India’ (1859); ‘Sketch of the History of the United States from Independence to Secession’ (1862); ‘President Lincoln Self-Portrayed’ (1866); ‘The War of American Independence’ (1876), etc.

LUDLOW, Roger, American colonial statesman: b. Dorchester, England, 7 March 1590; d. Virginia, about 1665. He was by profession a lawyer, came to Boston in 1630, was there assistant to the General Court of Massachusetts in 1630–34, in 1634 became deputy governor, but was defeated for the post of governor, removed with a Massachusetts colony to Windsor, Conn., and was, it is thought, the first practising lawyer in Connecticut. In 1639 he was a member of the convention for preparing a constitution, and the document is believed to have been drafted by him. In Connecticut also he was made deputy governor, and here, too, John Haynes, who had defeated him for the governorship in Massachusetts, was again victorious in the gubernatorial election. In chagrin Ludlow sought to evade his “evil genius,” as he styled Haynes, by founding the town of Fairfield. Here he held each public office of any importance, was a commissioner to the New England congress and revised the laws of Connecticut (published 1672). The Indians having threatened Fairfield, the citizens declared war against the Dutch, at whose instigation the savages were believed to be acting; and Ludlow was made captain of the forces. The New Haven General Court, however, quashed this proceeding and punished Ludlow's subordinate officers. Ludlow then (1654) withdrew in high dudgeon with all the town records to Virginia, where he quite disappeared.

LUDLOW, William, American soldier: b. Islip, Long Island, N. Y., 27 Nov. 1843; d. Convent, N. J., 30 Aug. 1901. He was graduated from West Point in 1864, entered the engineer service, was chief engineer of the 20th corps in the Georgia campaign (July-September 1864), in 1864–65 was engineer of the army in Georgia, was assistant engineer on Sherman's staff in the “March to the Sea” and in the Carolinas, and 13 March 1865 was brevetted lieutenant-colonel, U. S. A., for meritorious conduct in the Carolinas campaign. After various service, he was chief engineer of the Department of Dakota in 1872–76, engineer in charge of the Delaware River and harbor improvements and defenses in 1882–83, by authority of Congress chief engineer of the Philadelphia water department in 1883–86, and was at different times in charge of lighthouse districts and engineering work. In 1895 he became president of the Nicaragua Canal Commission and 13 August was promoted lieutenant-colonel of engineers in command of the lighthouse depot. In 1893–96 he was military attaché at the United States embassy in London. Commissioned brigadier-general of volunteers 4 May 1898, he became engineer-in-chief of the American army in the field in the Spanish-American War, served in the Santiago campaign, was made major-general of volunteers 7 Sept. 1898, and from 13 Dec. 1898 to April 1900 was military governor of Havana, in the rehabilitation of which city he took an important part. On 13 April 1899, he became brigadier-general of United States volunteers, and on 21 Jan. 1900 brigadier-general United States army. As president of the board of officers appointed for the consideration of the establishment of an army war college, he visited France, England and Germany for purposes of study. In 1901 he was ordered to the Philippines as commander of the Department of Visayas, but immediately returned on sick-leave. He wrote ‘Explorations of the Black Hills and Yellowstone Country’ and ‘Report of the United States Nicaraguan Canal Commission.’

LUDLOW, England, market town and municipal borough of Shropshire, on the Great Western and the London and Northwestern railways, at the junction of the Corve and Teme rivers. It is picturesquely situated and has many interesting remains of antiquity, including an ancient castle, an old city gate, and an ancient church and grammar school. The town was once a royal residence. Tanning and flour milling are carried on. The fortifications were dismantled in 1689. Pop. 5,925. Consult Clive, ‘History of Ludlow’ (London 1841) and Wright, ‘History of Ludlow’ (ib. 1851).

LUDLOW, Ky., city of Kenton County, situated on the Ohio River opposite Cincinnati, Ohio, on the Cincinnati, New Orleans and Texas Pacific Railroad. Its industrial establishments include railway repair shops, sheet metal works, brass works, etc. The city is a residential suburb of Cincinnati. Pop. 4,160.

LUDLOW, Mass., town in Hampden County, five miles northeast of Springfield, on the Boston and Albany Railroad and on the Chicopee River. It contains the Stevens Memorial Institute, the Ludlow Hospital, Hubbard Memorial Library and fine school buildings. It manufactures carpet yarn, twine, webbing, sacking, etc. Pop. 4,948.

LUDWIG, loot'vĭk, **Otto,** German dramatist and writer of short stories: b. Eisfeld, Thüringen, 12 Feb. 1813; d. Dresden, 25 Feb. 1865. His father, Ernst Friedrich Ludwig (d. 20 Jan. 1825), was a well-known Central German jurist; his mother's maiden name was Sophie Christiane Otto (d. 21 Nov. 1831). He attended the gymnasium at Hildburghausen (1828–29), as well as that of Saalfeld (1832–33), made an unsuccessful attempt to enter business with his uncle, Christian Otto (whom he later called “der dicke Herr” — the stout gentleman), and obtained his higher education chiefly by self-instruction, laying the foundations for a very extensive musical culture. The scene of his studies was mostly a pretty little garden and lodge, belonging to him, just outside the city of Eisfeld, where his friend Karl Schaller was his constant companion. One of the results of his musical studies was the opera

'Die Köhlerin' (performed privately at Eisfeld 1838), in recognition of the merits of which the Meiningen conductor, Grund, had an annual pension of 300 gulden conferred on Ludwig for three years. In 1839 Ludwig went to Leipzig to pursue his musical studies, chiefly under the direction of Mendelssohn. Illness and a shifting of his interest to literary studies prevented the successful prosecution of a musical career. In 1840, Ludwig published his first short story, 'Das Hausgesinde,' which shows distinct traces of the influence of Kotzebue's 'Rehbock' and Lortzing's 'Wildschütz.' After a return to Eisfeld in 1840, he was sent back to Leipzig, with a fresh supply of money, in 1842. His literary production was now increasing. Before moving to Dresden, in 1843, he had begun a tragedy, 'Der Engel von Augsburg'; a comedy, 'Hans Frei'; a prelude, 'Die Torgauer Haide'; and two short stories. He passed the summers of 1844 and 1845 very pleasantly at Niedergarsebach near Meissen (became engaged there to Emilie Winkler, 1844; married her, 1852). The winters of the succeeding years, until 1847, when, at Devrient's wish, he settled finally at Dresden, were spent in Leipzig. At Dresden he became one of a literary and artistic circle that included Karl Gutzkow, Langer, Oehme, Ludwig Richter, etc. It was here that he produced his most famous work, the tragedy 'Der Erbförster' (first performance, Dresden, 4 March 1850). This tragedy deals with the sad fate of a simple man who believes that since he and his ancestors have always occupied a certain office, the office has in a way become his property, and who is disastrously disillusioned when he finds that the mere authority of his employer, who owns the forest on which he is employed, is sufficient to throw him out of his life-position. The coloring is local, that of the Thuringian forest; the appeal is universal, in that it reveals the economic dependence of every man on him who holds the purse-strings. In 1852 came another great play, 'Die Maccabäer' (first performance, Vienna, 1 Nov. 1852), of which there had been an earlier version, called 'Die Maccabäerin,' a family tragedy in four acts, while the revised version had five. These two tragedies are considered by German critics as placing Ludwig almost on the same level with Hebbel (q.v.): they have great pith and vigor of speech and a tense, dramatic action. Ludwig is almost equally well known, however, for his short stories: 'Die Heiterethei und ihr Widerspiel' (written 1854, published at Frankfort 1857), and 'Zwischen Himmel und Erde' (written 1855, published Frankfort 1856). Unfortunately for his own productiveness, Ludwig then turned to exhaustive studies of Shakespeare, which were so engrossing as to cripple entirely any creative impulses of his own. They were edited by Heydrich (Leipzig 1871; 2d ed., Berlin 1902). Physical illness gained upon him more and more and he finally found none of his plans capable of maturing in his hands. His friendly intercourse with Auerbach, Julian Schmidt and Lewinsky helped to soften the hardships of his declining years. Although he produced little that was great or even complete, there is an impressive spirituality about his sufferings as well as a grandeur in his tireless strife to attain the highest pinnacles of art. The 'German Classics' (Vol. IX, New York 1914) contains translations of 'The Hereditary Forester' and 'Between Heaven and Earth.' Consult his 'Ausgewählte Werke' (2 vols., Leipzig 1896); 'Werke' (3 vols., Leipzig 1896); 'Werke' (6 vols., Leipzig 1900); 'Werke,' with biography by Adolf Stern (6 Vols., Leipzig, n. d.); 'Sämmtliche Werke' (10 vols., ed. by Merker, Munich 1912, unfinished). Consult also Treitschke, H. von, 'Otto Ludwig' (Leipzig 1871); Schmidt, Julian, 'Otto Ludwig' (in *Westermanns Monatshafte*, Vol. XXXV); essay by Bulthaupt in *Dramaturgie des Schauspiels* (Vol. IV, Oldenburg 1894).

JACOB WITTMER HARTMANN.

LUDWIG, Salvator von Toscana, lood'vĭk säl-vä'tōr fōn tōs-kä'nä, ARCHDUKE OF AUSTRIA, Austrian traveler: b. Florence, 4 Aug. 1847. He was the son of Leopold II, Grand Duke of Tuscany. His principal writings, all illustrated by himself and most of them published anonymously, are 'Levkosia, Capital of Cyprus' (1873); 'Yacht Voyage to the Syrtes' (1874); 'Los Angeles in Southern California' (2d ed., 1885); 'The Caravan Route from Egypt to Syria' (1878); 'The Balearic Islands,' superbly illustrated (7 vols., 1869–91); 'Around the World without Intending It' (4th ed., 1886); 'Paros and Antiparos' (1887); 'The Lipari Islands' (1893); 'Helgoland' (1900); 'Summertime in Thiaki' (1903); 'Zante' (1904); Wintertime in Thiaki' (1905); 'Observations on Levkas' (1909); 'Rockbound Majorca' (1910); 'Summer Dreams by the Seaside' (1912); 'Harbour of Port Palma in Majorca' (1913).

LUDWIGSBURG, loot'vĭks-bĕrg, Württemberg, town, 10 miles north of Stuttgart, dating from 1704, when it was founded by Eberhard Louis. It contains a royal residence, a monument to Schiller and beautiful gardens and public squares. It contains also a cannon foundry, arsenal and military training school. Metal and ironware, pianos, organs, cottons, woolens, linen and wire are manufactured. Pop. 25,000.

LUDWIGSHAFEN, loot'vĭks-hä'fĕn, Bavaria, city on the Rhine opposite Mannheim. It is a thriving commercial and industrial centre; is connected with Mannheim by a bridge over the Rhine, and has an improved harbor. Its chief items of trade are coal, iron and timber. Its industrial establishments include the Badische Anilin- und Soda-Fabrik, the largest chemical works in the world, fertilizer works, shoddy, flour, spirits, acids, cellulose, lumber, bricks, pottery, textile, machinery, wagons and bridge material manufactories. Its commercial life dates from 1843. It became a city in 1859. Pop. 83,300.

LUDWIGSLIED ('The Song of Ludwig'), an old High German poem written about 882 A.D. in Rhenish-Franconian dialect, to commemorate the victory of Louis III over the Normans at Saucourt (881). The Old High German readers of Wackernagel and Braune, as well as Müller's 'German Classics' (Vol. I, New York 1900), have reprinted the poem, the author of which is unknown.

LUECOCK, Naphtali, American Methodist bishop: b. Kimbolton, Ohio, 28 Sept. 1853;

d. Lacrosse, Wis., 1 April 1916. He was a graduate of the universities of Pittsburgh and Syracuse and a former professor at Allegheny College, Meadville, Pa. In 1912, four years prior to his death, he was elected bishop on the 15th ballot at the quadriennial conference of the Methodist Episcopal Church. He published several religious works; the last of these, 'Royalty of Jesus,' a collection of sermons, appeared in 1906.

LUFFT, lůft, **Hans**, hänts, German printer and publisher: b. 1495; d. 1584. He printed the first complete edition of Luther's Bible in two quarto volumes at Wittenberg, in 1534. He also printed other works of Luther and more than 100,000 copies of the Bible were issued from his press. See LOTTER FAMILY.

LUFKIN, Tex., city and county-seat of Angelina County, on the Houston, East and West Texas, the Saint Louis Southwestern and other railroads, 120 miles northeast of Houston. It has wagon factories, sheet metal works, foundries, machine shops, railroad repair shops, bottling works, canneries, etc. There is also a fine high school building. The water-supply system is owned and operated by the municipality. Pop. 2,750.

LUGANO, loo-gä'nō, Switzerland, town, in the canton of Ticino, on the north shore of Lake of Lugano, about 15 miles northwest of Lake Como. Its principal edifices are several churches; one, Santa Maria degli Angiolo, contains a fresco of the 'Passion,' by Bernardino Luini, as well as a 'Last Supper' and 'Madona and Holy Child' by the same artist; convents, a hospital and a theatre. The manufactures are chiefly spun silk and silk goods, chocolate and furniture. The transit trade is considerable. Till 1881 it was, alternately with Locarno and Bellinzona, the seat of the legislature of the canton of Ticino. It is the seat of a bishopric. A funicular railway runs to the top of San Salvatore (3,000 feet). Pop. 13,262.

LUGANO, Lake of (Latin, *Ceresius Lacus*), is partly in the Swiss canton Ticino and partly in Italy, between Lakes Como and Maggiore, into the latter of which it discharges its waters. It is of very irregular shape, a narrow body which throws out arms in all directions. Its length is about 20 miles, its breadth about one and one-half, and its depth about 300 feet. Its scenery is very wild and beautiful.

LUGANSK, loo-gänsk', Russia, town in Ekaterinoslav, on the river Lugan, 240 miles east of Ekaterinoslav. It contains a meteorological station, mineralogical museum, library, foundries, engine works, gun shops, candle works, leather mills and brick yards. Its industrial development dates from the establishment of a foundry here in 1795. Pop. 60,300.

LUGO, loo'gō, Italy, capital of the province Ravenna, on the left bank of the Senio and on the Castelbolognese-Ravenna and the Lugo-Ferrara railways. It has an ancient castle, a lyceum, gymnasium, technical school, library, etc. Its industries consist of rope-works and a lively trade in grain, wine, cattle, hemp and silk. Its annual fair, lasting from the 1st to 30th September, draws great crowds. Pop. 27,867.

LUGO, Spain, capital city of a province of the same name, on the left bank of the Miño and on the Palencia-Coruña Railway. It was the ancient Roman city Lucus Augusti and has five churches, one of which is a Romanesque cathedral of the 12th to 18th century, a priests' seminary, tannery, linen and hat factories and a considerable trade in cattle and pickled meat. The ancient fortified wall surrounding the town, with its towers, has been turned into a promenade. Near the railroad station is a noted sulphur spring known since Roman days. Its population is about 35,726.

LUGOS, lů'gȯsh, Hungary, capital, town of the county of Krassó-Szörény and junction of the Temesvar-Orsova and the Gattája-Maros-Illye railways. The town consists of the German and the Rumanian sections divided by the Temes River. It has a Minorite monastery and a convent. The chief industries are wine-culture, silk mills, distilleries, linen factory, etc. It is the seat of Greco-Catholic bishop and has a cathedral, courthouse, high gymnasium, etc. It was here that the Turks (1695) were victorious over the imperial General Veterani, and here also (1849) was the last resort of the fleeing Hungarian army and its government.

LUINI, Bernardino, bĕr-năr-dē'nō loo-ē'nē, Italian painter: b. Luino, on Lago Maggiore, between 1475 and 1480; d. soon after 1533. He was perhaps the most distinguished representative of the Milanese school, and between 1500 and 1533 was active as a fresco and easel painter in Milan and other places of northern Italy. He began his studies as the pupil of Ambrogio Vorgognone, whose influence is plainly seen in his 'Pietà' (1510) in the church of Santa Maria della Passione at Milan, though the blandness and delicacy of the early Milanese school is in his work somewhat animated and vitalized by the spirit he derived from the study of Leonardo da Vinci, under whose name some of his riper work has frequently gone. But though his frescoes are full of spiritual faces, and distinguished by the tenderest coloring and the most lifelike movement, he never quite made his own the grandeur in composition and passionate energy which distinguish the paintings of Leonardo. Most of his productions are found in Upper Italy. Many of his easel pictures are to be seen in the Ambrosiana (library), Brera (palace) and in private galleries at Milan; others in the cathedral at Legnano. In the Uffizi at Florence is his 'Beheading of John Baptist.' His chief work is 'The Enthroned Madonna with Saint Anthony and Saint Barbara' (1521), a magnificent fresco in the Brera. Other examples of this painter are now in the Palazo Sciarra at Rome, as well as in the Louvre, the National Gallery of London and the Berlin Museum. Consult the studies by James Mason in Jack's 'Masterpiece in Colour' series; and C. C. Williamson in 'Great Masters in Painting and Sculpture' (London 1899).

LUISE, loo-ē'zė, **Auguste Wilhelmine Amalie**, queen of Prussia: b. Hanover, 10 March 1776; d. Strelitz, 19 July 1810. She lost her mother in her sixth year, and was brought up in charge of her grandmother at Darmstadt. In her 17th year she was married to the

Crown Prince, afterward Frederick William III of Prussia. On her husband's accession to the throne she won all hearts by her beauty, grace and kindness of disposition. Her highest happiness was found in her husband and children, but she was also a queen who has left a deep impression on the annals of the Prussian court. In her travels with the king through the provinces she was constantly engaged in helping the poor and unhappy. When the war of 1806 broke out she accompanied her husband to Raumburg and, after the disaster of Jena, to Königsberg and Memel, setting an example to all by her unbroken fortitude. Before Tilsit she hoped to win from Napoleon more favorable conditions for her beloved country and interceded with the conqueror in vain. She is a household name to this day in Prussia: the Luise foundation for the education of girls was established in her honor, as was the Order of Luise by her husband, the king (3 Aug. 1814). It is the object of this order to honor patriotic and benevolent women of the Prussian nation. Consult Hudson, 'Life and Times of Louisa, Queen of Prussia' (1874); and Adami, 'Luise, Königin von Preussen' (1888); and her correspondence with her husband, published in 1903.

LUKE, author of the third Gospel and of the «Acts of the Apostles.» From the letters of Paul we learn that Luke was an honored fellow-worker, a physician by profession and a companion of the apostle in imprisonment. In his own two historical works he furnishes considerable information as to himself in addition to what Paul gives. It is plain that he was not a Jew by birth or religion, and it cannot safely be asserted that before he became a Christian he had been one of the «devout» persons of whom he repeatedly speaks, usually meaning such Gentiles as attended the Jewish synagogues without, however, becoming full proselytes. The fact that he was a physician, which profession was at his time largely in the hands of Greeks, his facile grace in the use of the Greek language, and the personal characteristics revealed in his writings, taken together, render it sufficiently certain that he was of Hellenic descent. His name, however, is of Latin origin, as Lukas is to be reckoned a diminutive of Lucanus (other derivations, even if possible are less probable, especially as Lucanus actually appears in the title of the Gospel in several Latin manuscripts), and the most plausible explanation of the situation is that he was the son of a Greek freedman of some wealthy Roman. From Eusebius we learn that he had at least a family connection with Syrian Antioch, which is confirmed by the way in which he speaks in Acts of that city. It is possible that he and Paul had earlier become acquainted at Antioch or even at Tarsus, and it is certain that they met at Troas where a personal appeal from Luke to the apostle to work in Philippi may have preceded the vision which convinced Paul that it was the will of God that he should cross to Europe. It seems that Luke remained in Philippi after Paul and his company had gone on to other cities and presumably for a time at least he practised his profession in that city, as supposably he had done previously. Whether during the intervening years he was in any way associated with Paul cannot be positively asserted, but it is certain that he rejoined him at Philippi on his way from Ephesus for his last visit to Jerusalem, and Luke is known to have been with him both in Jerusalem and at Cæsarea, though we cannot be sure that he was constantly with the apostle. He certainly sailed from Cæsarea with Paul and shared the fortunes of the voyage of which he has given such a marvelously vivid account. It appears that after the shipwreck on the coast of Malta he used his medical skill during the following winter for the benefit of the inhabitants of that island. We hear of him as with Paul during his first imprisonment, and again during his second, when Paul says «Only Luke is with me.» It may well be believed that Paul valued and encouraged Luke's presence, not only for companionship, but also on account of the helpfulness of the «beloved physician» in medical advice to him. Tradition has busied itself with Luke's career in later years, but we can be sure of nothing. It has been said that he was a painter, the first Christian artist as well as the first medical missionary, and an old painting attributed to him is still carefully preserved in Rome, but the story seems to have no substantial foundation. While the tradition that he died in Greece is the most probable of all the traditions which link themselves with his later years, yet nothing can be positively asserted as to where he spent those years or as to the date, place or manner of his death. For bibliography and connection of Luke with the third Gospel see article LUKE, Gospel According to.

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LUKE, Gospel According to. This Gospel, like Matthew, conforms in general to the outline of Mark, on which consequently it is generally regarded as dependent, but Luke contains a much greater amount of narrative material independent of Mark than does Matthew.

Contents.—The following is the general outline of the book, after a brief prologue. I. The birth, infancy and childhood stories (i, 5–ii, 52). II. Preparation for the ministry of Jesus, including the preaching of John and the Baptism and Temptation of Jesus (iii, 1–iv, 13). III. The early Galilean ministry (iv, 14–vii, 50). IV. The later ministry in Galilee and its neighborhood (viii, 1–ix, 50). V. The Perean ministry (ix, 51–xix, 27). VI. The entry of Jesus into Jerusalem and His final public teaching there (xix, 28–xxi, 4). VII. The Eschatological Discourse (xxi, 5–38). VIII. The closing scenes, last supper, agony in Gethsemane, trial, crucifixion, death, resurrection and ascension (xxii, 1–xxiv, 53). As compared with the other Synoptic Gospels are to be noted the long story of the Perean ministry to which, except for the last few verses, there is no parallel in either Mark or Matthew, the much fuller treatment of the appearances of the risen Christ and the narrative of the ascension. Much narrative material is found in this Gospel only, as, for example, five miracles are recorded only here, and there is also much teaching of Jesus which is peculiar to Luke, e.g., of the 41 parables Luke has 28, of which 17 are found in it alone. The discourses are as a rule carefully connected with their occasions, and seldom, if ever, is other material appended because of its likeness in thought or expression. Still another peculiarity of this Gospel is its introduction of the first great Christian hymns, the Magnificat (i, 46–55), the Benedictus (i, 68–79) and the Nunc Dimittis (ii, 29–32).

Purpose.— The purpose of the book is clearly stated in the brief introductory address to Theophilus, who seems to have been a Christian of at least respectable standing in society. It is not, however, to be thought that the book was intended for his sole use, but rather that it was dedicated to him as in some sense a representative of many Christians for whose benefit it was really prepared. The purpose given may be restated thus: to give an orderly account of the events which are the historical foundation of the Christian faith on the basis of accurate and thorough investigation.

Sources.— That there had been previous attempts to write the Gospel story, and that Luke had made thorough investigation the basis of his own work, Luke assures us in his prologue. But just what the sources of his information were and how he used them we are left to infer for ourselves. On careful study of his book in comparison with Mark and Matthew it is plain that he used the material which dominates the second Gospel as his chief source. The order of the book, its backbone, so to speak, is the same we find in Mark, and most of the material found there is reproduced here. At the same time it seems scarcely reasonable to hold that Luke had in his hands the Gospel of Mark as we now have it, for had he known the personal touches, the striking details plainly due to an eyewitness, as they now stand in the second Gospel, Luke with his literary instinct as well as historic sense could scarcely have failed to reproduce them. In whatever earlier form the Marcan material may have existed, it seems plain that we must regard this as Luke's chief source. Comparison with the first Gospel shows no less clearly that Luke used «Logia» or «Q» material, and at the same time we must hold that it lay before him in a form varying somewhat from the material which was employed in Matthew. While we are bound to recognize that Luke used his sources as a responsible writer of history, and not as a slavish copyist, the above inferences commend themselves today to the majority of critical scholars. (See article GOSPELS). As to the other sources from which he drew, we have no decisive clues. His stay of two years with or near Paul in his Cæsarean prison must have given him opportunities to gain access to many first hand sources of information, which would be still accessible in the year 60. It has been acutely noted that much of the material peculiar to this Gospel seems to bear in some sense the stamp of a woman. Not only is it characterized by a special gentleness and tenderness, which may be in part, but scarcely wholly, due to the character of Luke himself, but also in the large space and careful details given in relation to women, and, still more, in the manner of putting things, there seems to many conclusive evidence that one of his chief authorities was a woman. This is true not only in regard to the birth-stories, which would most naturally be connected, though perhaps indirectly, with Mary herself, but also in regard to many other incidents and sayings. Two such sources have been suggested as possible, the daughters of Philip (Acts xxi, 8, 9) and Joanna, the wife of Herod's steward (Luke viii, 3), who is named because of apparent acquaintance with affairs at Herod's court. He may also have gained much valuable information from other persons whose very names have perished.

Authorship.— Not only is the third Gospel uniformly associated in the tradition of the Church with the name of Luke, the companion of Paul, but this is confirmed by comparison with Acts, which also with no less unanimity of tradition is ascribed to Luke and which so shows itself to be his work as according to the judgment of the majority of scholars to make his authorship of both books a historic certainty. A special argument for this view is found in both the Gospel and Acts in the interest taken by the author in cases of disease and in the peculiar accuracy with which he speaks of it, this naturally implying that the author was a physician as we know Luke to have been.

Date and Place of Composition.— There is a decided difference of opinion as to the date. The extreme late date, perhaps 90–100, though not necessarily inconsistent with Lucan authorship, is at present advocated by so few that this view may now be regarded as negligible, especially as the alleged dependence on Josephus has been discredited. The real point of discussion lies in the relation to Acts and the implications of the latter book. The Gospel preceded Acts in composition, but the question is as to the date of Acts. That Acts need not have been written till as late as 80 has been held by many, and certain turns of expression in Luke have been taken as confirmatory of this date. On the other hand, it is held by a group of scholars, which apparently is gaining in number and influence, that Acts should be dated during Paul's imprisonment, not later than the year 64. If so, the Gospel must of course be dated still earlier, presumably in the year 60, or not much later. The place of composition would on the latter hypothesis naturally be Rome, though the gathering of the material and possibly the putting it more or less in shape might be connected with Cæsarea. If the later date (80) is accepted, there is no clue as to where it was written, as we have no historical hint and no trustworthy tradition as to where Luke lived and worked after the death of the Apostle Paul.

Authenticity and Value.— The trustworthiness of this Gospel depends upon the character of the sources employed and the accuracy with which they were reproduced. So far as can be ascertained Luke's sources were of a very high order. Especially his third main source, as also many of his reports of minor incidents, seems even as reproduced to bear the stamp of the testimony of an eyewitness who stood very close to the events recorded, the discourses repeated, the persons discussed. It also appears that Luke reproduced his material with scrupulous accuracy. This is shown, among other ways, by the number of Semitic idioms to be found in the Gospel as also in the first part of Acts. The sources used must, in part at least, have been originally in the Aramaic language, and, while Luke's own Greek style is admirable, he faithfully reproduces these idioms, so that his work contains proportionally quite as many Semitisms as do the other Gospels. The late conclusions of scholars, based in many cases on comparatively recent investigations and discoveries, are very favorable to Luke's accuracy as a historian as it appears in Acts, where the greater number of points of contact with the history and circumstances of the time give better opportunity for verification, and he is of course to be credited with the same accuracy in the Gospel. Accepting the trustworthiness of the material and the accuracy of its presentation, the value of the book is enhanced by the manner of the presentation. Beyond his literary style, which is singularly rich in vocabulary and natural and graceful in expression, Luke possessed an unusual gift or art of what might be called pictorial narration. His Gospel, which is the most comprehensive in the scope of matters reported, seems also to have a special character of universality. It presents Jesus at once as the man whose speech and character are ideal and as the pitying and pardoning Savior of every believing penitent, so that it has been called both the Gospel of repentance and faith and the Gospel of pity and pardon. Particularly does this universality appear in the character of those whose relation to Jesus is depicted. It is the Gospel in which womanhood and infancy find the largest place, and it is to be remembered that women and children were alike looked down upon at that time by both Jews and Gentiles. It is the Gospel which finds a special place for the publican, the Samaritan, the leper, in short, for all the humble, the despised and even the outcasts. When we thus see Jesus depicted in Luke's Gospel as scattering his grace of pardon and helpfulness on all who would receive, we can but feel that he was in rare sympathy with him of whom he wrote, and that he must have reflected to an unusual degree the kindliness, the gentleness, the helpfulness of which he speaks, and we lose all wonder that Paul called him «beloved,» as well as come to agree with Renan who called the Gospel of Luke «the most beautiful book there ever was.»

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LUKE OF LEYDEN (Lucas van Leyden, properly Lucas Jacobsz), one of the founders of the Dutch school of painting: b. Leyden, 1494; d. there, 1533. In earlier life he was taught painting by his father, Huig Jacobsz, and afterward by Cornelius Engelbrechten. At 9 he began to engrave, and in his 12th year astonished all judges by a painting, in water-colors, of Saint Hubert. In his 15th year he produced several pieces, composed and engraved by himself, among which the 'Temptation of Saint Anthony' and the 'Conversion of Saint Paul,' in regard to composition, characteristic expression, drapery and management of the graver, are models. After this he executed many paintings in oil, water-colors and on glass; likewise a multitude of engravings, which spread his fame widely. He formed a friendly intimacy with the celebrated John of Mabuse and Albert Dürer, who visited him in Leyden. His overwork at last resulted in hypochondria, and he imagined himself poisoned by envious painters, and hardly left his bed for the last six years of his life. The fullest and most beautiful collection of engravings by this master is in the library at Vienna. A triptych of Christ's 'Last Judgment' is in the town-hall of Leyden. His paintings are scattered through the galleries of London, Berlin, Rome, as well as in Holland, where is his masterpiece, 'Mount Calvary,' a composition containing some 80 figures. Much of his work has been lost owing to his having painted much on cloth in distemper.

LULEA, loo'lĕ-ạ, Sweden, capital of the Läns Norbotten, on the Sandö Peninsula at the mouth of the Luleelf on the Gulf of Bothnia. It is a terminal of the Lulea-Malmberget State Railway and has a college. Its main industry is ship-building, and it has considerable trade in lumber, woodenware, tar, salmon and reindeer. The iron ore from the Gellivara mines finds shipment from this port, which has steamship connection with Stockholm. The town was founded in 1621 and was devastated by fire in 1887, to be rebuilt on better plans with straight streets, etc. Pop. 9,021.

LULLY, lŭl'ĭ, or **LULLI, Jean-Baptiste** or **Giovanni Battista,** French composer: b. Florence, 1633; d. Paris, 22 March 1687. He went to Paris at the age of 14 and found work as scullion at the court, but, showing musical talent, he was made music page and soon became a member of the royal «24 violinists.» By 1652 he was their director and chief of the newly-established «16 petits violons» besides becoming, by 1653, court composer. His compositions for the royal orchestra were really the starting point of a true chamber music apart from orchestra music, the «Lully manière» becoming quickly a new type, inasmuch as the overtures and dance music of the opera ballet by him, put together in suites, were played apart from the stage. His great successes in placing French opera on the stage led to his being raised to the rank of royal music superintendent in 1672, taking Cambert's place as creator of a national French opera which not only differed from the Italian in its rôles, ballets and choirs but contained rhythmic elements that outweighed the melody. Among the most important of his operas are 'Alceste' (1674); 'Thesée' (1675); 'Atys' (1676); 'Phaëton' (1683); 'Roland' (1685); 'Armide' (1686). These operas remained in the height of popular favor till Glück and his work came on the scene. Most of his works appear in a recent edition of the *Chefs-d'œuvre classiques de l'Opera français* (Leipzig). Consult Radet, E., 'Lully homme d'affaires, propriétaire et musicien' (Paris 1891); Prunières, Henry, 'Lully' (Paris 1909).

LULLY, lŭl'ĭ, **LULL,** or **LUL, Raimon** (Doctor Illuminatus), Spanish scholastic: b. Palma, Majorca, 1235; d. at sea in sight of

Palma 1315. After having been attached to the court of James I of Aragon and leading a dissolute life, he retired to a cell on his estate, where he lived as an ascetic. In 1272 he joined the third order of Saint Francis. Encouraged by visions, he came to believe himself appointed to refute Mohammed and convert the Moslems to Christianity, and studied Latin, Arabic and logic in preparation for this work. Three times he went to Tunis with a view to converting its inhabitants, was twice imprisoned and banished, and on his third attempt was stoned at Bugia, from the effects of which he died. His 'Ars Demonstrativa Veritatis' was devised as an infallible and universal logical method to be used in making conversions, for the purpose of proving that the mysteries of faith were not contrary to reason. Lully believed that his method was destined to supplant the scholastic logic of the Middle Ages. He endeavored without success to obtain aid from Pope Nicholas in establishing colleges for the study of Oriental languages. The Ars Lulliana consists mainly in categorizing ideas and combining them mechanically, by which means Lully thought to exhaust their possible combinations. The method was taught and commented on in some schools of little influence in Spain, France and Italy, but it is hardly necessary to say that it never took root or produced any direct effects. Lully's works are very numerous and they were condemned as heretical by the Church. An incomplete edition is that begun by Galizinger (1721–42; Vols. VII and VIII never published). Consult Erdmann, 'Grundriss der Geschichte der Philosophie' (2d ed., 1869); Zweiner, S. M., 'The First Missionary to the Mohammedans' (New York 1902).

LUMBAGO from Latin *lumbus*, loin), a sudden and painful affection of the muscles of the back and tendinous attachments of the lumbar region usually following some strain in bending or lifting, which is but the final cause in upsetting a balance in the metabolism of certain groups of muscles which are under special unconscious emotional strain. See RHEUMATISM.

LUMBER INDUSTRY IN THE UNITED STATES, The. History.— The early history of lumbering in the United States is substantially the history of the country's settlement. Wood afforded the early settlers their building material and their fuel. Forest areas had to be cleared for cultivation and it was possible to use but a small part of the timber thus cut in the construction of pioneer homes. Trees were a hindrance to agriculture, of no value except as they afforded the bare necessities of life. Tremendous areas of timber were destroyed without thought of use for the product, until the progress of colonization had reached the point where there was a demand for logs, heavy timber and framing for buildings in the non-agricultural communities along the Atlantic Coast that later grew into towns and great cities. The early settlers had no tools more potent than the axe and the handsaw, but as the demand for building material grew the process of converting trees into a merchantable material passed through several evolutionary stages in which first water power and subsequently steam were applied.

The early sawmills ranged in capacity from 1,000 to 5,000 feet a day, board measure, and were operated principally in the white pine regions of the north Atlantic coast territory and in the Carolinas and Virginia. The product was heavy material of the sort then used in building and involved little production of thin lumber, which was produced with difficulty in these primitive establishments. With the development of cities along the seaboard, however, a new source of demand arose in the shipbuilding industry, for which wood was the most important raw material. The rise of shipping and the opening of many ports created a need for material for wharves and also afforded a means of developing a trade in timbers with the West Indies and Europe. Thus an industry gradually took form, its earliest tangible appearance in Maine and New Hampshire, with Vermont, New York and Pennsylvania following closely as producers of white pine, the one product of the forests of those States that was deemed valuable. These early lumbering operations were invariably located where streams were available for rafting logs to the mills. Unless the mill was situated on tidewater its function was limited to supplying local demand and the scope of the operation was necessarily small.

With the gradual opening up of the Central States, the lumbermen again assumed the rôle of pioneer, but the demand for lumber grew so rapidly that within a few years after the first commercial lumbering operation was established in what was then the Far West, Michigan and Wisconsin were producing great quantities of lumber needed in the prairie country. The first lumbermen to venture into the Lake States assumed that the supply of timber was inexhaustible and proceeded on that theory. Statistics covering production in Michigan, Wisconsin and Minnesota show that in 1873 mills in these States manufactured slightly less than 4,000,000,000 feet, practically all of which was white pine. With some slight interruptions the output increased steadily until 1890 when the maximum was reached with a total of 8,597,623,000 feet, after which pine production began a steady decline.

With a rapidly increasing population, and a gradual lessening supply of white pine from the Lake States, it was natural that the industry should turn to the tremendous forest resources of the Southern States, where yellow pine of several varieties, cypress and many varieties of hardwoods were obtainable. Thus, as the sawmills of Michigan, Wisconsin and Minnesota finished with their white pine supply, the operators, seeking other fields, found opportunities in the South and, in a few instances, on the Pacific Coast. Every timbered section of the country rapidly became of interest to investors because timber values kept moving steadily upward. The transcontinental railroads opened great areas of the West and acquired extensive land grants which were rapidly thrown on the market and seized by lumbermen and timber speculators who subsequently sold to lumbermen. And thus the industry spread wherever timber of merchantable character was obtainable, acquiring national scope and in a number of the States leading all other industries in capital investment, people employed and wages paid.

During the earlier stages of the industry's growth, the hardwoods, products of the "broad leaf" trees, such as the oaks, maples, birches, elms, basswood, hickory, gum, etc., received little consideration. In the white pine sections of Michigan and Wisconsin, later to become famous for their maple and birch, these woods were ignored by the early white pine manufacturers, in most instances, but the development of innumerable uses for hardwoods resulted in the rapid growth of what has become practically a separate branch of the lumber manufacturing industry, producing hardwood lumber. This branch of the industry is even more widely scattered than the soft wood branch and has developed methods, practices and a trade terminology of its own.

The most outstanding point of difference between the softwood and hardwood branches of the industry is to be found in the fact that the most important use of the softwoods and the use on which the softwood branch is really based is as a structural material. For structural uses, softwood lumber is ordinarily marketed, either rough or dressed, through lumber dealers who retail the commodity to building contractors and other consumers in substantially the same form in which it comes from the manufacturer. Hardwoods, on the other hand, are marketed chiefly to woodworking industries, such as door and millwork establishments, implement and vehicle manufacturers, the furniture and musical instrument trades, etc. Thus, with hardwoods, there is usually a process of further manufacture after the lumber leaves the sawmill and before it is ready for use by the consumer. It seldom reaches its consumer destination through the medium of the retail lumber dealer.

Timber Supply of the United States.— Foresters have disagreed sharply in their estimates of the actual amount of standing timber in the United States, it having been demonstrated that the early estimates were far under the mark and that the predictions of an impending timber famine which were given great prominence a few years ago were, for the time being, without foundation. In his book, 'Lumber and Its Uses,' Royal S. Kellogg, lately of the United States Forest Service, gives the following estimates as representing the minimum acreage and stand of timber:

FOREST REGIONS	Area Million acres	Stumpage Billion feet
Northern	90	270
Southern	150	630
Central	130	300
Rocky Mountain	100	300
Pacific	80	1,300
Total	550	2,800

The same authority estimates the stand by principal species as follows:

SPECIES	Billion feet
Douglas fir	650
Western pine	475
Southern pine	375
Western hemlock	150
Redwood	100
Western cedar	75
Sugar pine	60
Other Western softwoods	85
Cypress	40
Other Eastern softwoods	190
Hardwoods	600
Total	2,800

These estimates include all forest resources, publicly and privately owned. Of the publicly owned forests, largely embraced in the National Forest Lands held by the United States government, accurate estimates of area are obtainable. On 30 June 1917, the Forest Service, which is a bureau of the Department of Agriculture, estimated the aggregate area of the national forests at 155,166,619 acres.

Aside from the national forests, practically all of the forest area in which lumbering operations are proceeding is being managed without regard to reforestation, so that it might be assumed that the life of the country's privately-owned forests may be determined by dividing the total timber supply by the rate of normal timber cut and making proper allowance for the growth of the immature timber now standing. This method, however, fails to yield accurate results because it fails to take into account a large amount of natural reforestation which is bound to occur in cut-over areas that are not suitable for agriculture or stock-raising and that therefore afford an opportunity for regrowth, and also, because it ignores the fact that many substitutes are being found for lumber and are tending to reduce the per capita rate of consumption more rapidly in proportion than the population is increasing.

If no precautionary measures should be taken during the next 25 years, it is not improbable that the people of the United States would find themselves without an adequate timber supply in 75 years and that by the end of a century all of the privately-held timber would have been cut. Private enterprise cannot be depended upon to engage in timber growth because the process of growing trees is too slow to appear attractive to investors and also because the various States have levied unreasonably heavy and unscientific taxation on standing timber to such an extent that owners have been driven to rapid cutting rather than to conservation. It is probable, however, that the development of wider public knowledge of the problem of timber supply which may be expected as the result of the opening of schools of forestry in many of the leading universities and the consequent increase in the influence of the professional forester will result in a demand for a forestry policy, put into operation through the Federal government, the purpose of which will be to insure against the ultimate timber famine which otherwise might be expected. Such a policy necessarily will involve the co-operation of the States in arriving at an equitable and scientific method of taxing timber as a crop when cut, rather than on the present annual basis and will also necessitate more complete control over the protection from fire of those varieties of timber that are readily susceptible to fire damage and in which heavy fire losses occur practically every year. The Forest Service has demonstrated that timber can be protected against fire by two principal means: Education of the public to avoid carelessness in the woods which each year results disastrously, and the installation of efficient patrol systems that discover fires in the incipient stages and control them before they become conflagrations. The extension of such methods to private holdings as well as to reforestation projects operating under subsidy or some other form of governmental encouragement will eventually be necessary.

Manufacturing Processes and Methods.— The processes involved in converting timber into lumber fall into two principal divisions, Logging and Sawmilling. In all sections of the United States except the North Pacific coast these processes are commonly found as departments of a complete lumber manufacturing enterprise. In the States of Washington and Oregon, logging is frequently a separate business, and the sawmill buys its logs from logging contractors.

The first essential of a lumbering entérprise is a supply of timber within reasonable distance of the manufacturing point. On account of the bulky character of the raw material it cannot be hauled long distances for manufacture. The timber supply must be sufficient to amortize the plant investment in a reasonable term of years and the size of the plant will depend, usually, on the amount of tributary timber. The average life of a sawmill ranges from 15 to 30 years, depending on the locality and the character of the timber and plant.

In the early stages of the industry the raw material was usually conveyed to the mill by floating the logs down a stream or by hauling over snow and ice-covered roads during the winter season. These methods are still practised in some places, but in the majority of lumbering operations a railroad for handling the log supply is part of the enterprise. This railroad consists of a «main-line» which is of permanent character, and logging «spurs» which are projected into the timber and moved from time to time as the timber is taken out.

Trees are felled by hand labor and are cut into log lengths by hand labor or by power drag saws. They are then hauled to the railroad or «tram» either by the use of oxen or mules or by the steam «skidder, a machine operating on the railroad track which by means of wire cables and grapples pulls the logs to the railroad right-of-way. There they are picked up by a steam loader, which is a crane with swinging boom, and loaded on cars that are especially designed and equipped to handle logs. When a train of these loaded cars is made up, they are hauled to the mill and there dumped into the log pond or, if heavy hardwoods, «banked» or piled to await their entry to the mill. Where a pond is employed, it facilitates handling and sorting the logs, and also tends to clean them and keep them wet and in good condition for the saw.

The sawmill itself is apt to vary in equipment from a single circular saw, the simplest type, to one or more band saws with gang saws, resaws, edgers, trimmers and a variety of other high speed machines, and may range in capacity from a few thousand feet a day to 1,200,000 feet daily, board measure, which is the capacity of the largest mill in operation.

The product of the sawmill is rough lumber and the manufacturing operation may stop at this point; on the other hand, a planing mill may be operated as an accessory, its function being to surface or «dress» that portion of the sawmill product that requires such treatment, the equipment of the planing mill consisting of high-speed power machines of various types for turning out smooth-surfaced lumber, moldings and like products.

The lumber as it comes from the saw is «green» or wet and must be dried before it is shipped to market. This is accomplished by piling it on the yard in such manner that every piece has adequate ventilation, allowing it to stay in pile until it is «air-dried,» or by putting it through the steam dry kiln, which by subjecting it to degrees of heat and moisture that are scientifically determined according to the wood and its thickness dries it rapidly. The process of kiln drying is a delicate one, because too rapid drying may cause «checking» or cracking of the lumber and may result in many defects and blemishes that greatly reduce the market value of the product. Particularly in the case of thick material, if the moisture is suddenly entirely dried out of the surface of the piece while its centre is still moist, the uneven shrinkage that results is bound to show and greatly to impair the value of the piece.

Other equipment of the sawmill plant may include shingle and lath mills that utilize material especially suited for such purposes and also short pieces and other waste from the sawmill in the manufacture of these minor products.

In addition to ample storage yard space in which the lumber of the lower grades is piled and also the stock that is to be air-dried, the plant will usually include storage sheds for the accommodation of a stock of dressed lumber and perhaps moldings, flooring and other products of the planing mill.

Because plants of this character are usually located in rather remote places, the larger establishments usually include housing facilities for employees, fire protection equipment, a commissary store doing a general merchandise business and often an electric-light plant. In many instances, also, schools, churches and other public buildings are provided and maintained by the operators.

Where a mill is located on tidewater, it usually has dock and loading facilities for shipping its product to market by water, and thereby enjoys the advantage of low water freights. The great majority of the mills, however, are dependent on the railroads for their shipping facilities and their markets are usually restricted to some extent by freight rates which make unduly long hauls prohibitive. Thus, the Douglas fir producers of the North Pacific coast are able to ship the large structural timbers which can be turned out of giant fir logs to all parts of the United States because they have no competition for this trade, but the common building lumber made by these same mills cannot be shipped by rail to the eastern part of the United States because the freight is so high that yellow pine from the Southern States can be sold at lower prices.

Grading and Inspection of Lumber.— Lumber is graded according to its strength, durability and, in the case of material for certain uses, its external blemishes. Thus, in the case of a piece that will be used as a beam or joist, the appearance of the piece is of little consequence, but its strength is highly important and if it is to be used in a position where it will be exposed to moisture and heat the question of durability under such exposure becomes equally important. But in the case of a piece of oak that is to be used for a drawer front or a table top, strength is of less consequence than a clear surface.

The commonest of all the defects found in lumber is the knot, and it is apt to impair the grade and value of the piece in which it is found regardless of the use to which the material is to be put, since it affects both strength and appearance. A large knot in a partly rotten pocket may reduce the strength of the piece to the minimum, while a small tight knot may have little effect, as far as strength is concerned, but will deface the surface of the piece to such an extent that it cannot be used for an exposed part in a piece of fine furniture.

Other important and common defects that affect the grading and value of lumber are checks, splits, pockets of foreign material, such as pitch in pine or sand in some hardwoods; various kinds of stain or discoloration; wind shake, which is a product of strains set up in the fibre of the wood when the tree is bent by heavy winds and takes the form of splits; sapwood in a piece that is intended to be used where heartwood is specified; various kinds of rot and fungus decay, such as "red heart" in yellow pine and "peck" in cypress; "waney" or bark edges; warpage and twisting that affect the usefulness of the material; wormholes and like products of insect blights; discoloration from age and exposure, etc.

Each of the principal commercial woods is graded by fixed rules that establish certain grades and define the limits of each grade. These rules are made and maintained by associations of lumber manufacturers — also including in a few cases the wholesale distributors — and are usually enforced by means of an inspection force whose function is to settle disputes regarding grades and to make certain that the lumber inspectors employed at each mill are accurately and fairly interpreting the grades, as the lumber is sorted and marked when it comes from the mill. The associations maintaining grading rules and inspection service include Northern Pine Manufacturers' Association, Minneapolis, Minn. (white and Norway pine); Southern Pine Association, New Orleans, La. (southern yellow pine); North Carolina Pine Association, Norfolk, Va. (shortleaf and loblolly pine from Virginia and North and South Carolina sold under the trade name "North Carolina pine"); West Coast Lumbermen's Association, Seattle, Wash. (Douglas fir, western spruce, cedar and hemlock); Western Pine Manufacturers' Association, Spokane, Wash. (western white and yellow pine, larch); Southern Cypress Manufacturers' Association, New Orleans, La. (southern cypress); National Hardwood Lumbermen's Association, Chicago, Ill. (all hardwoods). Each of these organizations has established its grading and inspection service as standard for the particular wood or woods covered.

Volume of Production.— The statistics of the timber cut for the war years of 1917 and 1918 are not available; they would show a tremendous increase because of the great quantity of timber required for shipbuilding during the war and also the special woods required for airplane construction. The following table, compiled by the United States Forest Service, gives statistics of the country's lumber production 1899–1916:

YEAR	Number of active sawmills reporting	Quantity of lumber	
		Reported, M ft. b. m.	Estimated total cut, M ft. b. m.
1899	31,833	35,084,166	....
1904 [1]	[2] 18,277	34,135,139	43,000,000
1905	11,666	30,502,961	43,500,000
1906	22,398	37,550,736	46,000,000
1907 [3]	28,850	40,256,154	46,000,000
1908 [3]	31,231	33,224,369	42,000,000
1909	[4] 45,584	44,509,761	44,509,761
1910 [3]	[2] 31,934	40,018,282	44,500,000
1911 [3]	[2] 28,107	37,003,207	43,000,000
1912	[2] 29,005	39,158,414	45,000,000
1913	[2] 21,668	38,387,009	44,000,000
1914 [1]	[2] 27,506	37,346,023	40,500,000
1915	[2] 16,815	31,241,734	38,000,000
1916	[2] 17,269	34,791,385	39,807,251

[1] Custom mills excluded.

[2] Mills cutting under 50 M feet excluded.

[3] Including mills which manufacture lath and shingles exclusively (1,500 estimated).

[4] Includes 4,543 mills cutting less than 50 M feet, and all cooperage, veneer, millwork, box, furniture, and other factories cutting any lumber at all in 1909.

The table on following page compiled by the Forest Service lists the principal woods in the order of their commerical importance by reason of volume of production and affords a basis for comparison of production over a period of 17 years.

Characteristics of the Principal Commercial Woods.— For purposes of botanical classification, and also in commercial practice in the lumber trade, trees are divided into two principal classes, the Conifers or Softwoods, and the Broadleaf trees or hardwoods. The hardwoods are often referred to, also, as "Deciduous" but this term is unfortunate, since in fact some of the broadleaf woods are not deciduous. The terms "Hardwood" and "Softwood" have little relation to the actual hardness or soft character of the wood of any given variety. In fact some of the hardwoods are considerably less hard than the average of the softwoods.

The woods whose characteristics are discussed in the following paragraphs are those of chief importance from the standpoint of lumber production and commercial utility. No attempt is made to cover the tremendous range of minor woods.

Softwoods or Conifers.—Yellow pine, which leads all other woods in volume of production, includes three important species, longleaf pine (*Pinus palustris*), shortleaf pine (*Pinus echinata*) and loblolly pine (*Pinus tæda*) and several of less commercial importance. Longleaf pine is characterized by its greater average strength, is usually very resinous, shows a high percentage of heartwood and typical pieces are very durable, even under exposure to moisture and other adverse conditions without preservative treatment. It is a slow-growing timber and its strength and durability are practically proportionate to its density. It is particularly well adapted to the production of high grade structural timbers and construction lumber for use where strength and durability are required, or where hard wear is involved, as in the case

Quantity of Each Kind of Lumber Reported, 1914, and Computed Total 1915 Production.

KIND OF WOOD	1915	1914	1913	1912	1911	1910	1907	1899
	M feet b. m.	*M feet b. m.*	*M feet b. m.*	*M feet b. m.*	*M feet b. m.*	*M feet b. m.*	*M feet b. m.*	*M feet b. m.*
Total............	[1] 37,011,656	37,346,023	38,387,009	39,158,414	37,003,207	40,018,282	40,256,154	[2] 35,084,166
Yellow pine............	14,700,000	14,472,804	14,839,363	14,737,052	12,896,706	14,143,471	13,215,185	9,657,676
Douglas fir............	4,431,249	4,763,693	5,556,096	5,175,123	5,054,243	5,203,644	4,748,872	1,736,507
Oak............	2,970,000	3,278,908	3,211,718	3,318,952	3,098,444	3,522,098	3,718,760	4,438,027
White pine............	2,700,000	2,632,587	2,568,636	3,138,227	3,230,584	3,352,183	4,192,708	7,742,391
Hemlock............	2,275,000	2,165,728	2,319,982	2,426,554	2,555,308	2,836,129	3,373,016	3,420,673
Spruce............	1,400,000	1,245,614	1,046,816	1,238,600	1,261,728	1,449,912	1,726,797	1,448,091
Western yellow pine....	1,293,985	1,327,365	1,258,528	1,219,444	1,330,700	1,562,106	1,527,195	945,432
Cypress............	1,100,000	1,013,013	1,097,247	997,227	981,527	935,659	757,639	495,836
Maple............	900,000	909,763	901,487	1,020,864	951,667	1,006,637	939,073	633,466
Red gum............	655,000	675,380	772,514	694,260	582,967	610,208	689,200	285,417
Chestnut............	490,000	540,591	505,802	554,230	529,022	535,049	653,239	206,688
Yellow poplar............	464,000	519,221	620,176	623,289	659,475	734,926	862,849	1,115,242
Redwood............	420,294	535,199	510,271	496,796	489,768	543,493	569,450	360,167
Cedar............	420,000	499,903	358,444	329,000	374,925	415,039	251,002	232,978
Birch............	415,000	430,667	378,739	388,272	432,571	420,769	387,614	132,601
Larch............	375,000	358,561	395,273	407,064	368,216	382,514	324,509	50,619
Beech............	360,000	376,464	365,501	435,250	403,881	437,325	430,005	([3])
Basswood............	260,000	264,656	257,102	296,717	304,621	344,704	381,088	308,069
Elm............	210,000	214,294	214,532	262,141	236,108	265,107	260,579	456,731
Ash............	190,000	189,499	207,816	234,548	214,398	246,035	252,040	269,120
Cottonwood............	180,000	195,198	208,938	227,477	198,629	220,305	293,161	415,124
Tupelo............	170,000	124,480	120,420	122,545	98,142	92,071	68,842	([3])
White fir............	125,048	112,627	88,109	122,613	124,307	132,327	146,508	([3])
Sugar pine............	117,701	136,159	149,926	132,416	117,987	103,165	115,005	53,558
Hickory............	100,000	116,113	162,980	278,757	240,217	272,252	203,211	96,636
Balsam fir............	100,000	125,212	93,752	84,261	83,375	74,580	53,339	([3])
Walnut............	90,000	25,573	40,565	43,083	38,293	36,449	41,490	38,681
Lodgepole pine............	26,486	18,374	20,106	22,039	33,014	26,634	([3])	([3])
Sycamore............	25,000	22,773	30,804	49,468	42,836	45,063	46,044	29,715
All other kinds............	47,893	55,624	85,366	82,145	69,548	68,428	27,734	[2] 514,721

[1] Computed total 1915 production by kinds of wood. [2] Includes lumber cut in Alaska. [3] Not separately reported.

of flooring. Longleaf pine is sometimes known as «Georgia pine,» «hard pine,» etc., and in the export trade as «pitch pine.»

Shortleaf pine is a lighter wood, softer than typical longleaf, and typical specimens show a larger percentage of sapwood, which is always less durable than heartwood. It is more easily worked than longleaf and because it usually contains less resinous material is more suitable for finishing lumber, taking stains, paints and varnishes satisfactorily. It makes good flooring and the low grades are extensively used in the box trade.

Loblolly pine is the least valuable of the three principal varieties of yellow pine, being a variety of rapid growth seldom suited to uses requiring great strength, but yielding a good quality of interior finish. It is extensively used for boxes and crates. It is characterized by coarse annular rings and small heart.

The trade name «North Carolina pine» is used to describe a mixture of shortleaf and loblolly pines marketed from the States of North and South Carolina and Virginia. The term «Arkansas Soft pine» covers a peculiarly soft variety of shortleaf pine manufactured in Arkansas and sold largely for finish.

Douglas fir (*Pseudotsuga taxifolia*) is the most important product of the northwestern part of the United States, particularly Oregon and Washington, and also of British Columbia. In respect to supply it is the most important timber of the United States and in utility covers practically the same range as the yellow pines. Its most important use is in building construction, and eventually it will be the most important wood used in building.

White pine, by virtue of its light weight and soft texture, is the most favored of all soft woods for uses where strength is not the chief factor, being used extensively in building construction and also in the manufacture of many articles requiring a wood that is soft, easily workable and free from pronounced grain, such as musical instrument parts, foundry patterns, etc. In addition to the common white pine of the Eastern and Lake States (*Pinus strobus*), Western white pine (*Pinus monticola*), which is frequently marketed as Idaho white pine, and the sugar pine (*Pinus lambertiana*) of California and Oregon are legitimate members of the white pine family.

Cypress (*Taxodium distichum*), which is produced chiefly in the South Atlantic and Gulf Coast States, is one of the most valuable of American woods for those uses requiring great durability under exposure to moisture. Heart cypress is practically immune from decay and is therefore favored for the construction of water tanks, greenhouses, in the manufacture of cross-ties, shingles, siding and for many other uses involving a degree of durability found in no other American wood.

Hemlock is of two species. Eastern hemlock (*Tsuga canadensis*) is produced chiefly in New York, New England, Pennsylvania, West Virginia, Michigan and Wisconsin. Western hemlock (*Tsuga heterophylla*) is found chiefly in the North Pacific coast section. The chief uses of hemlock are as a general utility building lumber and for boxes and crating. The wood of the eastern hemlock is light, not particularly durable under exposure without the protection of paint or preservatives, but strong and serviceable. The western variety is more dense and possesses many characteristics similar to those of Douglas fir.

Spruce as a trade term covers several species which are found widely scattered from the Atlantic to the Pacific coasts. The most important are *Picea rubens,* found chiefly in New England, New York and Pennsylvania and sold as «Eastern spruce»; *Picea canadensis,* native to the Great Lakes region, and usually termed «white spruce,» and the Sitka spruce (*Picea sitchensis*) found in the North Pacific coast territory. Spruce is one of the lightest, softest and most readily workable of American woods and therefore a rival of white pine for many uses. It also furnishes a large part of the domestic supply of pulp for paper manufacture.

Redwood (*Sequoia sempervirens*) is a California product noted for the great sizes to which it grows. It is a light, durable wood, used extensively in building, particularly for siding and shingles. It possesses the characteristic of resisting fire to an unusual extent.

The various cedars, including many species, furnish the principal raw material of the shingle industry and the most satisfactory wood for the manufacture of pencils. The name «cedar» as it is understood in the lumber trade includes such species as the junipers and the arborvitæs, the *Libocedrus,* or incense cedar, and *Chamæcyparis thyoides,* commonly known as white cedar. The junipers are more widely distributed than any other American species.

Hardwoods or Broadleaf Timbers.— Oak is the most important of the hardwoods in volume of production. Botanically there are more than 50 oaks, the most important of which are the white oak (*Quercus alba*) and red oak (*Quercus rubra*). The oaks yield a wood that is very useful in building construction because of its varied and beautiful texture or «figure.» It is very hard and will withstand extreme wear, qualities that make it valuable in the manufacture of flooring, interior finish, furniture and cabinet work of many varieties, vehicles and agricultural implements, and in ship and boat building. The greater part of the production of oak centres in the Southern States, although the timber is found in practically all parts of the country.

Maple includes several species, the most important commercially being the hard maple (*Acer saccharum*), also known as the «sugar maple.» This wood is found scattered widely through the Northern and Eastern States, but attains its greatest importance in Michigan. It is a strong, dense hardwood, the most important uses of which are for flooring, finish and furniture.

Birch of several species is found chiefly in the Northeastern and Great Lakes States, the most important variety being the yellow birch (*Betula lutea*), produced in largest quantity in Wisconsin and Michigan. The wood is heavy and tough and is particularly suited to the manufacture of finish and furniture. It is extensively used stained in imitation of mahogany, although it possesses characteristics that makes it very attractive when finished in the natural.

Red gum (*Liquidambar styraciflua*) is second to oak as a hardwood product of the Southern States. It is moderately soft, possesses an attractive figure and is extensively used for finish and furniture. Properly stained it affords a good imitation of mahogany. Other important uses are for boxes, cooperage and vehicles.

Chestnut (*Castanea dentata*) is produced in largest quantities in the Eastern States. It is used chiefly in the production of interior finish, furniture, musical instruments and coffins.

Yellow poplar (*Liriodendron tulipifera*) is found chiefly in West Virginia, Tennessee, Kentucky and scatteringly through the Southern States. It is one of the softest of the hardwoods, readily worked and finds its most important outlets to market in the production of millwork, boxes and crating, furniture and vehicles. It was at one time the most important material used in the production of automobile bodies but was largely displaced by the development of satisfactory metal bodies.

Among the other hardwoods of chief importance are included the elms, the chief species of which are the white elm (*Ulmus americana*) and the rock elm (*Ulmus racemosa*) which is also known as cork elm. The most important uses of elm lumber are in the manufacture of boxes and crating and in furniture of the cheaper varieties. Basswood (*Tilia americana*), which has a very wide range of growth, produces a very soft lumber of straight grain that is used in the production of boxes, crating, millwork, wood novelties, trunks, etc. Tupelo gum (*Nyssa aquatica*) is found in the same localities as cypress and is used largely for boxes and crates. Cottonwood (*Populus deltoides*) is another southern product that is used chiefly for box and crating purposes. Black walnut (*Juglans nigra*), once the most favored of American woods for furniture manufacture, has become comparatively scarce and is now manufactured chiefly from scattered woodlots. It is used in the production of fine furniture and in the making of gunstocks, for which it is preferred over all other woods.

Manufacture of Imported Woods.— The manufacture of woods imported in the log has become an important annex to the hardwood branch of the lumber industry, the products of chief importance being mahogany and Circassian walnut. Mahogany as it is known in the trade includes *Swietenia mahogani,* from Central America and southern Mexico, and *Khaya senegalensis,* from Africa. Though the latter is not a true mahogany botanically, it possesses characteristics that place it commercially on a par with the product from the American tropics. The chief uses of mahogany are for furniture and interior finish. Importers of mahogany also bring into the United States a considerable quantity of Spanish cedar, the principal use of which is for cigar boxes. Circassian walnut is a wood of very pronounced figure used principally for interior finish and furniture.

The Veneer Industry.— The manufacture of wood veneers is an important subsidiary factor of the lumber industry. Veneers range from the extremely thin material used in the production of fine furniture, piano cases, etc., to the thick veneers used in producing baskets and light boxes. Thin veneers are produced by «cooking» the log until it is very soft and slicing it. The heavier veneer stock is produced by sawing the log with a high-speed circular saw. Mahogany, Circassian and American walnut are the most important of the woods used in making thin veneers of fine furniture and finely figured mahogany logs suitable for the production of veneers bring extremely high prices. Since furniture veneers are apt to be but one-thirty-second of an inch in thickness or even less and are usually sold by the square foot, a single log will produce enough stock to cover a very large amount of surface.

In some cases veneer mills are operated in connection with sawmill plants, but generally veneer manufacture is a separate enterprise.

Preservative Treatment of Wood.— In the early period of the lumber industry's development only those woods of most serviceable character were marketed, but with the expansion of demand that has come in recent years, bringing with it the rapid extermination of the varieties that had first preference for commercial purposes, it has become necessary to develop means of utilizing practically all woods that grow to commercial size. One of the principal difficulties with some of the timbers that have appeared in the markets in recent years is their lack of durability. On this account, the development of processes of wood preservation by chemical treatment has become an important adjunct to the lumber industry, deriving a large part of its impetus from the desire of American railroads to get away from the expense of frequent renewal of cross-ties, poles and posts. It has been estimated that the average life of an untreated cross-tie is about seven years and that the same tie, properly preserved, will last 17 years.

The most important agents used in preserving wood are coal tar creosote, zinc chloride and mercuric chloride. Various methods of applying the preservative include brush treatment, dipping in an open tank, application of the solution under pressure and the combination of a vacuum to open the pores of the wood and pressure to force the solution into them. Preservative salts that are soluble in water are of no value in the treatment of wood that is to be exposed to the elements and for this reason the creosoting processes have made most headway. Creosoting plants are in operation in all parts of the United States and are the most influential factors in the practical conservation of America's timber supply thus far developed. Before the European War a large part of the supply of creosote oil came from Germany. According to data gathered by the American Wood Preservers' Association, the consumption of creosote oil, domestic and foreign, and zinc chloride, 1910 to 1914, inclusive, was:

YEAR	Domestic creosote (gallons)	Foreign creosote (gallons)	Zinc chloride, made in U. S. (gallons)
1910	18,184,000	45,082,000	16,803,000
1911	21,511,000	51,517,000	16,360,000
1912	31,136,000	52,531,000	20,752,000
1913	41,700,167	66,673,192	26,466,803
1914	28,026,870	51,307,736	27,212,259

Exports and Imports of Forest Products.—The export business is an important factor in the lumber trade of the United States. The growth of exports of sawed lumber from the United States is indicated by the following figures: 1870, $2,817,906; 1880, $5,086,880; 1890, $9,974,888; 1900, $17,731,696; 1910, $36,774,219; 1913, $61,975,919.

The principal export markets for American lumber are western Europe, South and Central America, Mexico and the Orient. Extensive studies of these markets have been made by the Department of Commerce to encourage the development of a greater foreign business, made possible by the devastation of Europe's forest resources during the great war.

As the result of this activity of the government and the enactment of the Webb bill, legitimating combinations for the development of foreign trade, a number of substantial export corporations were formed after the close of the European War to develop this class of business.

Aside from a small quantity of valuable hardwoods, the greater part of the lumber imported into the United States comes from Canada. The volume of the import business has been variously affected by changes in import tariffs and by war conditions during the years 1914–18. The following table indicates the value of wood and manufactures thereof imported from all sources during typical years from 1900 to 1917, inclusive:

YEAR	Value
1900	$11,711,446
1905	16,707,735
1910	27,489,155
1911	24,709,532
1912	24,414,943
1913	27,851,295
1914	12,181,772
1915	4,456,846
1916	4,583,269
1917	5,207,265

Tendency of Lumber Prices.— The manufacture of lumber in the United States, practically from the beginning of the industry, has been characterized by extreme fluctuations in prices. No other industry is more sensitive to conditions affecting general business, a fact that is accounted for, to some extent, by the immediate association between lumber and the building business. When building is active the demand for lumber is proportionately active, but building is subject to extraordinarily diversified influences that induce violent fluctuations in volume. This fact, coupled with the intensive competition that has long existed within the lumber industry, is responsible for frequent periods of depression, in the course of which lumber prices at the mills have actually gone below the costs of production.

In a general way the tendency of lumber prices is always upward, forced thus by economic influences. The lumber manufacturer is converting into a merchantable commodity a natural raw material representing a large investment on which interest charges begin accumulating as soon as the property passes into the hands of a private owner. In addition to interest on the investment, also, taxes paid on the property from the time the government — State or Federal — granted title up to the time of actual cutting are a charge that must be included in the cost of the product. The interest item is cumulative and the tax rate has shown steady increase in most sections of the United States. Consequently it becomes necessary for the producer to exercise care in computing the cost of logs entering the mill and this cost is ever increasing.

Another factor that tends toward higher prices at the mills is the necessity of logging less accessible timber. When timber was more plentiful and the manufacturer was able to select his supply at practically his own price, the operation could be conducted without regard to conservation and the timber which presented serious logging difficulties could be passed by. To-day, however, the less accessible timber is too valuable to be ignored and is taken, even though it cannot be delivered to the mill at the low cost possible with better located stumpage. Small logs, also, are handled at considerable higher cost in the woods and through the mill, but have become too valuable to be left in the woods as they once were.

Still another potent factor in bringing about higher prices is the change that has come in labor conditions. Before the beginning of the European War wages paid in the lumber industry were low, as compared with wage scales in other large industries, and the hours of labor were long. In some sections 11 hours and in others 10 hours constituted a day's work. One of the effects of the war was to reduce the working day throughout the Pacific Northwest to an 8-hour basis, and another was a general increase in wages, in many cases exceeding 100 per cent, with little prospect of eventual return to former wage schedules.

As the cost of lumber at the mills is composed chiefly of raw material cost, which shows constant increase, plus labor cost, which before the war was abnormally low, plus amortization of plant which proceeds more rapidly as the timber supply diminishes, it is an economic certainty that, disregarding extraordinary fluctuations such as occurred during the war period, the price must show gradual increase until it reaches the point at which timber can be grown, converted into lumber and marketed at a profit. That point marks the limit of rise of lumber prices, from the standpoint of the lumber industry, but in fact is arrived at by ignoring one particularly important factor — the competition of other materials that can be used in place of lumber. The economic forces that tend to force the price of lumber upward are absent or inconsequential in the cases of most of the competing materials, but it is evident that lumber cannot find a market at prices materially in excess of those applying on such competing materials. Consequently the lumber industry is rapidly approaching the point at which it will be compelled to meet the problem of constantly increasing raw material and manufacturing costs on the one hand and a price limit fixed by competition on the other. The solution will have to be found in the more complete utilization of the raw material and in the manufacture and marketing of by-products of many varieties. It is estimated that waste through the leaving of potentially valuable raw material in the woods ranges from 20 to 40 per cent, but this waste is largely unavoidable and will continue so until, by the development of mechanical and chemical processes, material now left in the woods can be profitably converted and marketed.

What has been said about price tendencies relates to the prices prevailing at the mills. The cost of lumber to the consuming public, however, is not subject to such extreme fluctuations as the mill price, for the reason that on the average it includes a large item of freighting cost, in which abrupt changes are not apt to occur. In the case of lumber hauled a long distance by rail, the freight charges may exceed the mill price of the material. The opening up of water transportation facilities, therefore, becomes an important influence tending to lower the cost of lumber to the consumer. On account of its bulky character it can be shipped by water at a fractional part of the cost of rail transportation. The opening of the Panama Canal made possible the shipment of Pacific coast lumber to the Atlantic seaboard at freight rates that compare favorably with rail rates on pine from the Southeastern States, thereby creating competition in Eastern markets that tends to hold prices down, to the benefit of the consumer. The actual effects of the canal's operation were greatly delayed because of the scarcity of tonnage during and immediately after the close of the European War, but the beginning of 1919 brought Douglas fir from the North Pacific coast into active competition in the Eastern markets.

By-products of the Lumber Industry.—The most important of the by-products made from wood waste include paper of several varieties, fibre board, methyl (wood) alcohol, ethyl (grain) alcohol, charcoal, acetate of lime, pyroligneous acid and numerous tars and oils. Paper and fibre board are manufactured by mechanical and chemical manipulation of slabs, edgings and other saw-mill waste. Wood alcohol, acetate of lime, pyroligneous acid and charcoal are products of destructive distillation. Grain alcohol is produced by a process involving the extraction of the starch content from wood waste, its conversion into sugar and distillation. In addition to these processes methods have been developed for recovering the turpentine and resinous contents from longleaf pine stumps, and for the manufacture of various fabrics from wood waste, including an imitation silk sold as «fibre silk.»

The production of tanning extracts from the bark of oak, chestnut, hemlock and other woods is an important means of utilizing what otherwise would be a waste product, but is carried on as a separate business, the lumber business furnishing the raw material.

Careful surveys made by competent chemists have demonstrated that in connection with almost any large lumbering operating the complete utilization of the raw material through the development of suitable lines of by-products may be made to increase the profits of operation to such a degree that the lumber price can be lowered materially, the by-products operation thus carrying its proportionate share of the overhead cost of the business. It is not possible, however, for the individual operator of a small saw mill to undertake enterprises of such character, since they invariably involve large investments in plant facilities, and the development of the by-products business is tending in the direction of centralized plants that can utilize waste products from all mills in contiguous territory.

WILLARD C. HOWE,
Editorial Director of «Lumber.»

LUMBER STATE, a popular designation for the State of Maine, because of the large forests and the great number of its people engaged in lumbering.

LUMBRICOID, lŭm-brĭ'koid, from Latin *lumbricus*, intestinal worm, and the Greek *ειδοι* form. One of the *nematodes* or round worms, which are classed in four families: (1) ascarides, (2) strongylides, (3) trichotrachelides and (4) filariæ. In the first is the *ascaris lumbricoides*, known at least 2,000 years; Aristotle naming them, but the Linnæan name being used at this day. Their appearance resembles an ordinary earth worm, the males being from four to six inches long and the females from 10 to 14, even reaching 18 inches. The mouth is three-lobed and both ends are pointed, the tail of the male having a double spiculum or penis. The female may contain 60,000,000 eggs according to some estimates. Development, it is believed, takes place after leaving the fæces, and they endure adverse temperatures and conditions well. The mode of development is as yet not clear, nor its manner of entering the human system. Drinking water is generally supposed to be the source whence it finds its way to the intestine. It develops rapidly in the human intestine, but whether from embryo or after its escape from the egg is unknown. The middle part of the small intestine is where it locates, several together; sometimes in great numbers, even up to 1,000. It infests also the pig and beef; it is found in every country, but thrives best in warm climates, dryness not affecting its destruction. A year is supposed to be the limit of the existence of the *Ascaris lumbricoides*. Cobbold developed the egg to embryo stage in fresh water and sustained life three months. Eggs fed to animals had negative effect. The presence of a few ground worms in the intestines probably create no symptoms, but when numerous they bring about itching of the nose, colic of the umbilicus, distention of the epigastrium, lack of appetite, mucous or bloody evacuations and other symptoms.

Round worms find their way at times into the nose, larynx or eustachian tubes, and in subcutaneous tissue are discoverable in «worm abscesses.» Santonin and its compounds are the most successful remedy.

LUMINIFEROUS ETHER. See ETHER.

LUMINOSITY OF ANIMALS is most familiar to us in the fire-fly and glow-worm, on land, and in what is called phosphorescence, at sea; with regard to the latter popular term, arising naturally from the resemblance to the wavering light of phosphorus, it may be said that the phenomenon has nothing to do with phosphorus. It appears in plants, especially in the mycelium of fungi and certain agarics, often causing rotten wood, decaying vegetables, etc., to glow in the dark. Bacteria on such objects are another source of «phosphorescence,» causing the shining appearance of putrid fish. There appears to be no essential difference between the luminosity of plants and of animals, and it is believed by some that the power to produce it belongs to all creatures, although visible in only a few, mostly living in the sea. On land some myriapods and worms, and various insects or their larvæ and in the ocean a great number and variety of invertebrates, including mollusks (cephalopods), crustaceans and many fishes, manifest luminosity. «On a dark night,» says a writer, «the crest of every wave often seems to break in a pale glow, the wake of the vessel is a trail of light, and an oar dipped in the water seems on fire.» The narratives of voyagers abound in descriptions of such phenomena seen at their best in the tropics, but observable even in Arctic waters. The origin and nature of this light are not clearly known, although it has been extensively studied. It appears to be dependent on the presence of oxygen in an alkaline medium. This luminescence is never manifested by fresh water, although so common among marine fishes, which are in contact with sodium chloride or calcium chloride. It is thought by some to be the product of the chemical action of oxygen on fatty constitutions in the cells, by others of two special substances, one an enzyme, the other an element of the blood that betrays itself as light when it flows into a luminous organ. Watasé considers the light-giving material a cell-secretion, not a product of a gland. Still another view is that the light is the effect of chemical action resulting in an electrical manifestation. The spectrum of the fire-fly shows greatest intensity in the central (green) part, and disappears before reaching either end of the solar spectrum — that is, it exhibits neither heat nor chemical energy. Langley and Very, who devoted much effort to its investigation, called it the «most economical light known,» and very near to the ideal of light without heat. The manifestation of such light may occur in three ways. In the minute protozoans (Noctiluca, etc.), which sometimes are met with in warm seas in such dense masses that the water is like a glowing broth, the light issues from a myriad of points, a diffuse illumination along the muscle fibres.

In a class that includes such mollusks as the pholads, and also the copepod crustaceans, the photogenic material is ejected as a liquid (slime) from the body, according to Watasé, and becomes luminous only by contact with the water, or, more strictly, with the oxygen mixed with it; and the same is true of luminous terrestrial worms and annelids, but here the material emanates as fine granules that glow when they encounter the air. A third class includes the more highly organized insects, squids, fishes, etc., which possess definite light-producing organs.

The luminous insects with few exceptions are beetles of the pentamerous families Lampyridæ and Elateridæ. The former family is well represented in North America, and furnishes us with several species of fire-flies. The females of some species in this group are wingless, or nearly so, creep about among the herbage, and are called glow-worms; in other species it is the larvæ that are glow-worms. Their luminous organs are situated on the head or the abdominal segments or both, in positions varying with the species, and consist of cells just beneath the cuticle, reached by nerves and surrounded by a wrapping of tracheal filaments, supplying air — the necessary oxidizing agent. Their light is usually given out in intermittent flashes, but in some species continuously, and in all, apparently, it is under nervous control. The most famous of the fire-flies is the cucuyo of the American tropics (*Pyrophorus noctilucus*), one of the Elateridæ; but several other species equal its powers. This beetle is an inch and a half or more long, dull in color, and has on each side of its thorax an oval, whitish «lantern,» from which at will streams a bright light. Gosse ('Naturalist's Sojourn in Jamaica,' 1851) says that when this beetle was handled these spots would ignite gradually, «the centre of each tubercle first showing a point of light which in a moment spreads to the circumference and increases in intensity until it blazes with a luster almost dazzling.» The color of the thoracic light is a rich yellow-green. In a pitch-dark room this insect gives so much illumination as to cast a definite shadow of any object on the opposite wall, and when held two inches from a book the whole line may be read.»

Gosse and the many others acquainted with these phosphoric beetles describe another light on their abdomen, just behind the legs. «When fully illuminated,» the Beebes (‹Search for a Wilderness,› 1910) tell us, «this area was brilliant and of a figure-of-eight shape. The light, however, was radically different from that of the thorax, being yellowish and candle-like, giving an illusive impression of an opening from the incandescent interior of the insect. In flight the abdominal searchlight comes into play, burning brightly with a strong yellowish glare.» In other species the glare is orange or reddish, and the insect races along like a railroad train, with two green head-lights and a red tail-light. Beebe found that two or three in a glass tube answered the purpose of an electric flash-light. These and similar insects are worn in the hair, and otherwise adapted to the purpose of ornament by the Mexicans and Brazilians.

One of the surprises of the early explorers of the depths of the ocean was that many of the tropical pelagic fishes had luminous organs; and for a long time it was believed that all of these came from the abysses where no particle of sunlight penetrated, and that thus the stygian depths were illuminated. Later investigations have modified this view. The luminous fishes belong mainly to the families Stomiatidæ, Sternoptychidæ, Scopelidæ and Ceratidæ. All these are pelagic families and have species ranging from the surface to the deepest bottoms (see DEEP SEA EXPLORATION). The extensive explorations of the ocean depths carried on in the *Valdivia*, the *Michael Sars* and other vessels in recent times show that light-organs are «specially characteristic of fishes belonging to the upper 500 meters in warm oceanic waters.» This is true of the crustaceans and cephalopods, in the latter case squids, living at intermediate depths. The light-organs in these animals are distributed in various parts of the body, and are highly complicated, eye-like glands, each having not only a lens to increase its power, but a layer of black pigment in the rear, to act as a reflector. There is no doubt that this structure enables the fishes and squids to project the light in definite directions. The function and importance of these organs have been much discussed; and the purpose is still in question. «Is it in order to illuminate the surrounding water, to avoid foes, or to recognize their own kind?» asks Hjort (‹Depths of the Ocean,› 1912). «The answers,» he replies, «would probably tend to show that the many different kinds of light-organs serve different purposes.» Brauer finds that their position is precisely the same in all individuals of any one species, and concludes that they replace, in the darkness of the depths, the specific color-marks or «recognition-marks» of surface or terrestrial animals. As it seems certain that this emission of light is intended to be seen, the relation between them and the eyes of these fishes and other oceanic animals must be studied; but the data for this are defective and confusing. It appears that a remarkable coincidence exists between the development of light-organs and eyes in pelagic fishes. The Scopelidæ, Sternoptychidæ and Stomiatidæ, which live above 500 meters, possess well-developed light-organs and eyes, while from 500 meters downward light-organs and eyes both decrease in size. Along the sea-bottom, however, the fishes have only eyes and no light-organs.» The eyes of the bottom fishes (Macrurus) are large, as if to admit as much as possible of a scanty supply of light. In those depths all the invertebrate animals are aglow, clothed in a copious mucus that emits light; and it is believed that this illumination is sufficient to enable the big large-eyed bottom fishes to see what is about them. The situation is, nevertheless, full of puzzling contradictions. Consult books mentioned under DEEP SEA EXPLORATION; and for the most recent discussion of the matter consult Murray and Hjort's ‹Depths of the Ocean› (London 1912).

ERNEST INGERSOLL.

LUMINOUS PAINT, a paint containing phosphorus, which after exposure to strong light becomes luminous in the dark for a time. It is used for street signs, buoys, clock dials, etc. See also PAINT, PHOSPHORESCENCE.

LUMMIS, Charles Fletcher, American author: b. Lynn, Mass., 1 March 1859. He was graduated from Harvard in 1881, went to Los Angeles, Cal., there was an editor of the *Daily Times* (1885–87), and later became editor of the monthly *Out West*. He spent five years among the Pueblo Indians of New Mexico, studying their speech and customs. Among his writings are ‹A Tramp across the Continent› (1892); ‹The Land of Tiempo› (1893); ‹The King of the Broncos› (1897); ‹The Enchanted Burro› (1897); ‹The Awakening of a Nation› (1898), and the collection, ‹The Man who Married the Moon, and other Pueblo Indian Folk-Stories› (1894).

LUMPKIN, Joseph Henry, American jurist: b. Oglethorpe County, Ga., 23 Dec. 1799; d. Athens, Ga., 4 June 1867. He was a brother of Wilson Lumpkin. He was graduated from the College of New Jersey (now Princeton) in 1819, studied law in the office of Judge Cobb at Athens, was admitted to practice in October 1820, and practised at Lexington, Ga., until 1844. In 1824 and 1825 he represented Oglethorpe County in the State legislature of Georgia, and in 1845 became associate justice and soon after was appointed chief justice of the Georgia Supreme Court. He was one of the chief organizers of the Lumpkin Law School of the University of Georgia, and occupied the chair of law in the school in 1859–61. He resumed the professorship in 1865, and retained it until his death. In 1833 he assisted in the compilation of the Penal Code of Georgia. Both as an advocate in criminal cases and as a judge he is described as exceedingly able. For many years he was prominent in the temperance movement.

LUMPSUCKER, an extraordinary marine fish (*Cyclopterus lumpus*), of oval, ugly form and allied to the sea-snails (*Liparis*) and gobies. It is remarkable for the brilliant red and purple colors which the male puts on in the breeding season in the spring, when it approaches rocky shores on both sides of the northern Atlantic to deposit its spawn. This fish has the short ventral fins so united as to form a sucking disc by which it attaches itself to the bottom and holds on against waves and currents, while it preys upon small fishes, crustaceans, etc. It is well known and eaten in Scotland under the name «cockpaidle.»

LUMPY JAW. See ACTINOMYCOSIS.

LUNA, loo'na, **Alvaro de,** Spanish poet, constable and leading spirit of the reign of John II: b. 1388; executed Valladolid, 22 June 1453. A natural son of Alvaro de Luna, a rich Spanish noble, he was nephew of the famous «anti-pope» Benedict XIII and near relative of the Count of Morala and the Marquis of Vilueña. He was sent to the court, while still a boy, by his uncle, the bishop of Toledo (1408). There he soon became page to John II, who conceived a great affection for him; and he became a general favorite at court, especially among the ladies. While scarcely of age he began to exercise a strong influence at court partially through the liking of the king for him, and partially through the royal high majordomo, Juan Hurtado de Mendoza, son-in-law of the king. Luna followed the progress of John II from place to place and to his standard flocked young men of the highest rank to bask in the sun of the favorite of the sovereign. The infante, Don Enrique, rose against the king and seized him and Luna; but the latter, with the help of friends, succeeded in freeing himself and the king (1420), whom he afterwards strove to make independent of the infante and the nobles who supported him. To this end he gathered about him a strong party which stood for the maintenance of royal power and fidelity to the ruling sovereign. The infante, Enrique, and his party were driven from the court. The property of the most conspicuous of the followers of the infante was confiscated, among these being the powerful hidalgo Ruy López Dúvalos. This confiscated property was divided among the followers of the king; and, as the leader of these, Luna obtained great wealth, including several castles and the title of Count San Esteban, to which was added that of high constable, a position which gave him control of the royal forces and empowered him to look after the security of the sovereign's person. Next to the king, he was, therefore, all powerful; so powerful indeed that he dared to imprison the infante. In 1425, through the influence of his enemies, the king was forced to exile Luna from the court. But, during his absence of a year and a half, the unsettled condition of the country grew rapidly and steadily worse; and finally Luna was recalled, with great rejoicing. But civil war broke out between the different independent principalities of Spain. In the attempt to restore order and to defend the interests of the king Luna took a very prominent part. He made several successful campaigns and captured a number of strongly fortified towns. In 1430 a truce for five years was concluded. Luna at once set out on a war expedition against Granada, then a Moorish stronghold, and, defeating the enemy several times, he reached the outskirts of the capital (Granada). When victory was in sight he was forced to retire owing to trouble in his own forces, and personal illness. Again in 1431, with additional forces, he invaded Granada, conquered numerous towns and laid waste the land in the name of his sovereign, John II of Castile. Notwithstanding these brilliant military successes, Luna's enemies at home constantly conspired against him for the next 20 years. After a while their hands were strengthened by the support of the second wife of John II, who finally succeeded in poisoning the mind of the king against his favorite, who was finally arrested at Burgos, tried and condemned to be beheaded at Valladolid. Among his other great talents, Alvaro de Luna was a poet of no mean order and a great friend of the troubadours. His songs are graceful and harmonious and often beautiful. He has a good command of language and the quick and sensitive imagination of the poet. He was one of the most finished musicians of his age; and the touch of the musician is seen in his poetry. But his prose, which possesses the harmony of the poet, is stronger than his poetry. His ‹Librode las claras é virtuosas mujeres› is a stout defense of the fair sex. The work is divided into three books. These treat, respectively, of the women of the Bible, the pagan women and the Christian women. The style of this work is simple; and the great number of references which it contains from sacred and profane history credit the author with a wide historical knowledge for his age. Consult Ticknor, ‹History of Spanish Literature› (New York 1854); ‹The Chronicle of Alvaro de Luna› (Madrid 1784); ‹Chronicle of John II›; Quintana, José, ‹Vidas de españoles célebres› (Vol. XIX, Biblioteca de Autores Españoles).

LUNA, Pedro de, pā'drō dā, **anti-pope**: b. Spain, 1334; d. Peñiscola, Valencia, 1424. He was sprung from a noble family of Aragon, and, after entering the priesthood, became distinguished as a canonist, and was appointed professor in the University of Montpellier. He received a cardinal's hat in 1375 and was elected to Avignon as anti-pope in 1394. The conclave of cardinals annexed as a condition to his election, that he should resign if ever an opportunity occurred when, by so doing, he could put a stop to the schism. This he refused to do although he was deposed by the Council of Pisa (1409), and by that of Constance (1417). Banished from Avignon, he retired to the fortress of Peñiscola, near Valencia, where he spent the rest of his life in excommunication.

LUNA, lū'na (the moon), among the Greeks *Selēnē*. Her worship is said to have been introduced among the Romans in the time of Romulus. She had a temple on the Aventine, one on the Capitol, a third on the Palatine.

LUNA MOTH, one of the largest and most beautiful of the great American silkworm moths, *Tropæa luna*. Its general color is delicate green, there is a purple brown band along the front edge of the fore wings and a pair of richly colored ocelli upon each of both pairs of wings, the hinder pair of which terminate in long curving «tails.» The caterpillar grows to a length of about three inches and is pale bluish green with a pearl-colored head; it has a pale yellow stripe along each side of the body, and a transverse yellow line on the back between each two abdominal segments. It feeds upon leaves of forest trees, as the hickory, walnut, etc. The cocoon is formed of a very thin, leaf-like material with little silk, and is usually found upon the ground.

LUNACY, LUNATIC, etc. See Insanity.

LUNALILO, loo-nā-lē'lō, **William C.,** king of the Hawaiian Islands (1873–74): b. 1835: d. 3 Feb. 1874. He received a good education and was liberal in his political views. His health failed soon after his ascending the throne and he paid inadequate attention to administrative business.

LUNAR CAUSTIC. See Nitrate of Silver.

LUNAR TABLES, *in astronomy,* ponderous volumes of solid figures which are the numerical development and tabulation of the analytical theory of the moon's motions and perturbations. See Moon.

LUNAR THEORY, The, *in astronomy,* the deduction of the moon's motion from the law of gravitation. See Moon.

LUNAR YEAR. See Year.

LUND, Sweden, town, in the län of Malmöhus, on an extensive plain, about eight miles from the Sound and 24 miles east of Copenhagen. It is a very ancient place, and was once surrounded with wooden fortifications, and had its warehouses filled with the merchandise and treasures. In the Middle Ages it was the largest city in Scandinavia; the monarchs were elected kings of Scania on a hill in the immediate vicinity. The present town occupies a large extent of space, and is very irregularly built. It has an ancient Romanesque cathedral, one of the finest churches in Sweden, erected in 1145 and recently restored; a university, founded in 1688, attended by over 1,000 students, and occupying buildings erected in 1878–82, while the old building contains the library (180,000 volumes), historical museum, etc. With the university are connected a zoological museum and a botanic garden. The town boasts of a statue of Tegnér, and the house in which he lived. Sugar refining, glovemaking and iron-founding are among the industries, and there is a trade in agricultural produce. It was ceded by Denmark to Sweden in 1658. Pop. 20,423.

LUNDY, Benjamin, American abolitionist: b. Hardwick, Warren County, N. J., 4 Jan. 1789; d. Lowell, La Salle County, Ill., 22 Aug. 1839. His parents were members of the Society of Friends. At 19 he removed to Wheeling, then in Virginia, where he labored as an apprentice to a saddler. At this place, which was a centre of the slave trade in those days, his attention was first directed to the subject of slavery. He subsequently settled in business in Saint Clairsville, Va., where in 1815 he originated an anti-slavery association, called the "Union Humane Society" and had a membership of nearly 500. Soon after a journal entitled *The Philanthropist* was commenced at Mount Pleasant, Ohio, to which Lundy contributed. He then visited Saint Louis, where he remained nearly two years engaged in a newspaper exposition of the slavery question. At Mount Pleasant, he commenced, in 1821, the publication of the *Genius of Universal Emancipation,* the office of which was removed to Baltimore in 1824. In 1825 he visited Haiti to make arrangements for the settlement of emancipated slaves and a few years later he made a second voyage there for the same purpose. His efforts for abolition aroused the bitter hostility of the slave-holding class and the slave dealers, one of whom assaulted Lundy in Baltimore in 1827. In 1828 he visited the Eastern States, where he formed the acquaintance of a number of prominent abolitionists, one of whom, William Lloyd Garrison, afterward became associated with him in editing his journal. Garrison and Lundy differed in their policies for bringing about abolition. Lundy favored colonization abroad while Garrison advocated immediate emancipation on the soil. In 1830–31 he traveled in Canada and Texas to obtain subscribers to his paper and to continue his observation on the condition of the slaves. He continued his literary connection with the *Genius of Universal Emancipation* as long as it was published, and was the first to establish anti-slavery periodicals and the delivery of anti-slavery lectures, and probably the first to intoduce the formation of societies for the encouragement of the produce of free labor. Consult Armstrong, W. C., 'The Lundy Family and Their Descendants of Whatsoever Name' (Nutley, N. J., 1902); Earle, 'The Life, Travels and Opinions of Benjamin Lundy' (Philadelphia 1847).

LUNDY'S LANE, Battle of, also called the Battle of Niagara, or Battle of Bridgewater, a severe engagement fought on Canadian soil near Niagara Falls, 23 July 1814, between British and American forces. Two days after the defeat of the British under General Riall at Chippewa by Brigadier-General Scott 5 July 1814, the American forces under General Brown, numbering about 3,000 men, crossed the Chippewa River and took post at Queenstown; Riall, after throwing a portion of his force into Fort George, retreated to a strong position near the head of Lake Ontario. Occasional skirmishes took place between the outposts of both armies; but Brown, finding that he had no battering cannon to besiege Fort George, and being unwilling to leave that fortress in his rear, fell back after a few days to the Chippewa. Here on the 25th he received intelligence that General Drummond, who had reached Fort George with British reinforcements, had crossed the Niagara River at Queenstown to attack Fort Schlosser, where the American supplies were deposited. Scott was at once detached with 1,200 men to make a demonstration at Queenstown, and about sunset unexpectedly came up with Riall and his whole force at the head of Lundy's Lane. The small American force received the full fire of the British infantry, and held their ground until the arrival of the main body of the American army. Fighting continued during the night. Scarcely an officer remained unwounded in the American ranks, and the men, faint with their exertions and tormented by thirst, were ready to sink with exhaustion. Unwilling, however, to relinquish the field, they replenished their ammunition from the cartridge boxes of their fallen comrades and foes, who covered the ground around the battery, and then calmly awaited the assault of the British.

After an hour's pause the latter, reinforced by fresh troops from Fort George, advanced under General Drummond to the last assault. The conflict which ensued was more deadly than ever. At length the enemy, broken and foiled at all points, retired. Brown and Scott being now disabled by wounds, the command devolved upon Colonel Ripley, who, finding the enemy indisposed to renew the attack, drew off his troops to the camp. In this battle, the most obstinately contested perhaps ever fought upon the American continent, the British force of 4,500 beside greatly outnumbering their opponents, had the advantages of position and preparation. Against these odds the troops of Brown fought with an unparalleled valor and obstinacy which did much to disabuse the country of the idea, then prevalent, that American troops could not cope with the trained veterans of Europe. According to the official accounts, the American casualties amounted to 571 wounded, 171 killed and 110 missing; and the British to 559 wounded, 86 killed and 42 prisoners. Ripley, finding his forces reduced to less than 2,000 effective men, retired to the neighborhood of Fort Erie, having first destroyed the bridge over the Chippewa and a portion of his stores.

LÜNEBURG, lu'nē-boork, Germany, capital city of the government district of the same name in the province of Hanover, on the navigable Ilmenau River. It contains many ancient dwellings but the well-laid-out gardens of the suburbs give the place a modern aspect. There are four churches including the Catholic, and a synagogue besides. The Michaelis Church dates from the 15th century, and the Johannis Church, with its five naves, belongs to the purest 14th century Gothic period. The Nikolai Church and its colossal central nave dates from the 15th century. Among its other notable buildings are the ancient courthouse in the market place, full of art treasures, the great structures of the Michaeli monastery (now a seminary), the old Kaufhaus, etc. Its industries consist of lime-kilns, iron, cement, carpet, stoneware and dye works, a horsehair weaving factory, wax bleachery, etc. The trade is ably assisted by its Chamber of Commerce and consists of exports in wine, grain, lumber, hay, straw, wool, wax, etc. It is the junction of several railways. Among its other public buildings figure the gymnasium and realgymnasium, the Evangelical teachers' seminary trade school, museum, public library, etc. Documentary evidence of this town dates from 1228 and municipal rights were conferred in 1247. As a member of the Hansa League in the Middle Ages the city had considerable prominence and great wealth. In the Thirty Years' War the city was taken by Duke George of Brunswick-Lüneburg and fell to a relatively low estate and has since gone through the vicissitudes of Brunswick and Hanover. Its population, in 1910, was 27,790. Consult Volger, 'Urkundenbuch der Stadt Lüneburg' (Lüneburg 1872–77); Bodemann, 'Die älteren Zunfturkunden der Stadt Lüneburg' (Hanover 1883).

LUNENBURG, loo'nĕn-bĕrg, Canada, town, seaport, capital of Lunenburg County, in the province of Nova Scotia, and about 40 miles west-southwest of Halifax. The first settlement was made by Germans, in 1753, and it still bears interesting marks of its origin. It has a large, safe harbor. The chief industries are ship-building and fishing. Lunenburg is the chief seat of the deep-sea fisheries of Canada and it exports considerable fish and lumber to the West Indies. It is the seat of a United States consular agent. The settlement was raided by American privateers in 1782. Pop. about 2,681.

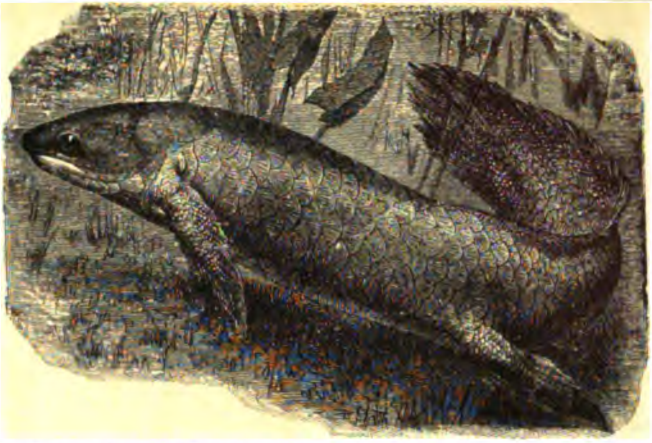
LUNÉVILLE, lü'nā-vēl', France, city, in the department Meurthe-et-Moselle, on the river Meurthe, where it is joined by the Vezonze, and junction of lines of the East Railway. It has a beautiful 18th century church (Saint Jacques), a great palace formerly belonging to the dukes of Lorraine but now used as barracks and a lovely park. There are also a town-hall, war memorial erected 1870, statue of Bishop Gregory, a college library, museum, chamber of agriculture, etc. The chief industries are glove, stocking, lace, yarn and textile factories, also potteries and brewery. Considerable trade is done in grain, wine and tobacco. It was the capital of a county in the 10th century and fell into the possession of the duchy of Lorraine in 1344. When Stanislas Lesczynski, former king of Poland, came into the possession (1735) of Lorraine he made this city his residence. In history the city is noted for the Peace of Lunéville (1801) between Germany and the French Republic, by which Belgium and the left bank of the Rhine was apportioned to France, while Milan and Mantua fell to the Cisalpine Republic, Venice and its district as far as the Etsch (Adige), Istria and Dalmatia with Cattaro were given over to Austria. As compensation for the loss of their territory on the left bank of the Rhine to the Imperial princes the ecclesiastical foundations were secularized and the free cities were annexed to such principalities. The city suffered greatly during the German invasion 1914–18. Pop. about 25,587. Consult Baumont, 'Histoire de Lunéville' (Lunéville 1900); Sloane, W. M., 'Life of Napoleon Bonaparte' (New York 1910).

LUNGCHOW, or **LUNGCHOWFU**, China, walled city in the province of Kwangsi, located on the Tsokiang, at the confluence of the Sungchi-kiang and the Kaoping-ho, near the border of Tonkin with which much trading is done. It is on the trade route between Yünnan and Tonkin and much import trading is done through its open port, amounting in 1912 to 76,532 taels, with an export trade of 7,303 taels. It has a population of about 20,000.

LUNGFISH, a fish of the group *Dipnoi* (q.v.), few existing species of which remain. These are mostly sluggish fishes of tropical fresh waters, whose respiratory organs are lung-like. See BARRAMUNDA; CERATODUS; LEPIDOSIREN; and ICHTHYOLOGY.

LUNGS, the principal organs of respiration in air-breathing vertebrates. They are enclosed in the chest, an air-tight chamber which, mainly by means of the diaphragm (q.v.), acts as a bellows and moves the air in and out of them. The purpose of the inhalation of air is to supply oxygen to the blood and to remove carbon dioxide. There are two lungs, one on the left, the other on the right side of the chest, and between them and almost completely covered by them are situated the heart

LUNG-FISHES



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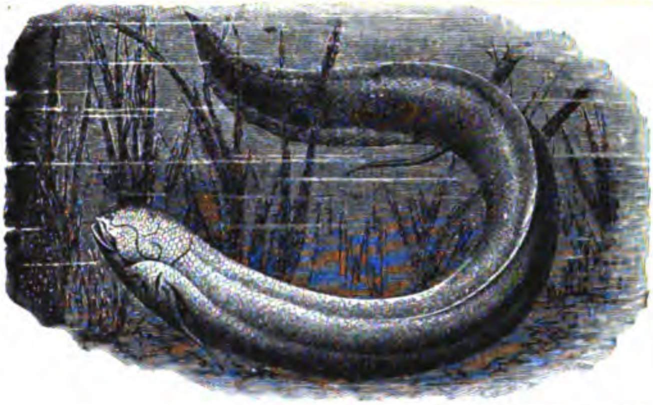

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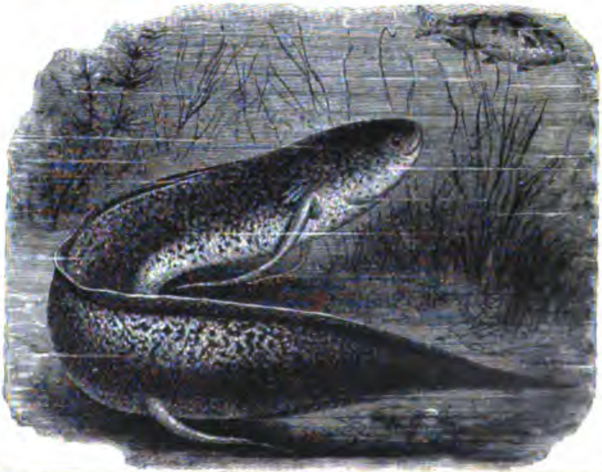
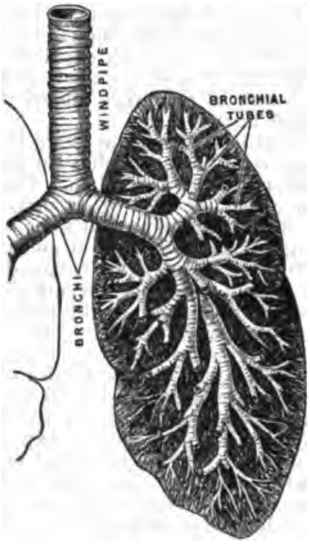


1 Australian Lung-fish or Barramunda 2 Amazonian Mud-fish or Lepidosiren
3 African Mud-fish or Protopterus

and the great blood-vessels springing from it, the œsophagus, the thoracic duct, etc. The left lung is the smaller of the two, and both consist of a mass of ramified tubes, branches of the trachea, which unite them. The color of the lungs is pinkish white at birth, which changes to the mottled slate color of the adult lungs, and the still darker hue of the lungs of the aged. Through the walls of the lungs all the blood of the body passes, receiving oxygen and throwing off carbonic acid. The simplest lung imaginable would be an elastic membranous bag, well supplied with blood-vessels, and with a pipe connecting it with the air; the most complicated lungs that exist are essentially of that construction, the purpose of the complications being merely the enlarging of the surface exposed to the air.

In all air-breathing vertebrates, the atmospheric air reaches the larynx through the nasal and the buccal cavities, then passes into the trachea, and into its ramifications which are called bronchi or bronchial tubes, and from these tubes into membranous pouches named alveoli. The terminal twig of a bronchial tube is a small canal, in which are found many openings or orifices of very short tubes, which are the ultimate ramifications of the tube. The lung-substance is composed of the alveoli, the air-sacs, the small bronchi, blood and lymphatic vessels and nerves; the whole enclosed in a membrane that surrounds each of the lungs and is known as the pleura. The trachea or windpipe extends from the lower part of the larynx, of which it is the continuation, to the middle of the thorax, where it divides into the two large bronchi. It is situated in the middle line of the body, in front of the last cervical and the first five or six dorsal vertebræ. In the back part of the trachea there are transversal muscular fibres of the unstriped variety. The fibrous tissue found in the trachea belongs to the two varieties of yellow elastic and white fibres. The mucous membrane is thin and in perfect continuity with that of the larynx and that of the bronchi. Its most remarkable feature is that its epithelial covering is composed of ciliated cells having in high degree the vibratile movement. All along the trachea there are many mucous glands, and these are especially numerous upon its back part. The cilia lash upward, and thus keep the passages free from mucus and remove foreign particles. As the passages become smaller they lose their cartilages, and the muscles form a continuous circular layer. The length of the trachea is from four to five inches. The average transversal diameter of this tube is between 9 and 12 lines in adults. The anterior two-thirds of the trachea is cylindrical, the posterior third is a flattened wall. In the neck the trachea is covered by the skin and a few flat muscles; in the chest it is placed between the two lungs and covered by muscles, lymphatic glands and the bony and cutaneous walls of the thorax. The structure of the trachea is complicated. This tube is essentially composed of an internal layer which is a mucous membrane and an external one which is fibrous. Imbedded in these membranes are from 16 to 20 cartilaginous pieces, with the shape of a horseshoe, or of a ring one-third of which is missing. These incomplete rings are placed transversely at nearly equal distances one from the other; they give to the anterior two-thirds of the trachea the cylindrical form.

The essential parts of the lungs are the air-cells or air-sacs, in which the function of respiration is performed. They are estimated to be about 600,000,000 in number and to be about one-two hundred and fiftieths of an inch in diameter. They consist of somewhat elongated cavities, which communicate with a bronchial ramification by a circular opening, usually smaller than the cavity of the cell. The air-cells are arranged in groups and separated from each other by thin walls. Many small, shallow, cup-like depressions, separated from each other by portions of membrane, are found at the bottom and on the lateral walls of the air-sacs. These, the alveoli, have no communication with each other except by their opening in the cavity of the air-sac. An epithelial layer exists in the air-cells and the alveoli. The walls of the air-cells are formed of a thin membrane in which the blood and lymph-capillaries ramify. Minute openings lead from the air-cells into the lymph-spaces of the membrane. The membranous walls are partly formed of elastic tissue. It is this that gives to the lungs their elasticity. At the root of the lungs the membrane known as the visceral pleura is continuous with a membrane which lines the chest-cavity (the parietal pleura). The space between the two is the pleural cavity; it is in reality a large lymph-space, and communicates with the lymphatics of the pleura. Owing to the air-pressure within the lungs, the two pleuræ are closely pressed together, the lungs entirely filling the chest-cavity.



The lungs are united with the heart and with the trachea by a part called the root, which, in each side, is composed of the large bronchus, a branch of the pulmonary artery, two pulmonary veins, and smaller vessels and nerves, the whole being almost completely covered by the pleura. Each lung is divided into lobes, two in number in the left one and three in the other. Each lobe is divided into lobules, which are arranged on the bronchial tubes like grapes on a bunch. Each lobule is surrounded by condensed areolar tissue mixed up with yellow elastic tissue. Each lobule is a fair representation, on a small scale, of a whole lung, as it hangs upon a bronchial tube, a branch of the pulmonary artery, branches of bronchial vessels and nerves. In the roots of the lungs the two large bronchi divide, the right into three, and the left into two bronchial tubes, one for each of the pulmonary lobes. The primary bronchial tubes are very short, and divide into two or three smaller tubes, each of which gives off two or three divisions. Before reaching their termination, the tubes branch off four or five times more.

The weight of the lungs varies much according to age and sex. In adult men the two lungs weigh from 40 to 50 ounces, and in women from 28 to 35 ounces, thus, being the lightest of the organs of the body. The ratio of the weight of the lungs to that of the body is as 1 to 30 or 40. The specific gravity of the lungs is very slight, and, unless the air has been expelled from the cavities of the bronchial tubes and of the alveoli, any part of the lungs dipped into water will rise and float.

As respiratory organs the lungs bear a certain average relation to the physical proportions and condition of the individual. The average amount of air in the case of an individual five feet eight inches in height that goes in and out of the lungs at each inspiration and expiration is about 20 cubic inches; this is called the tidal air. This is only about one-seventh of the total capacity of the lungs, and as the ordinary adult takes about 18 breaths a minute, the air of the lungs would be renewed only about twice a minute if it were not for the diffusion of gases. By means of forced inspiratory movements the ingoing tide may be increased by 120 cubic inches; by means of a forced expiration the outgoing tidal air may be increased by 90 cubic inches. After the most forced expiration possible there always remain within the lungs about 90 to 100 cubic inches of air. So that if a person takes as deep a breath as possible, and then makes as forced an expiration as he can, he will drive out 120+20+90=230 cubic inches of air. This is termed the respiratory capacity. Since the tidal air is only 20 cubic inches, and 180 cubic inches remain in the chest after an ordinary expiration, it follows that the air directly changed during the respiration is not that really within the lungs themselves, but is that within the nose, windpipe and larger bronchi, the pipes that result from the branching of the windpipe. Therefore the changes of the air within the essential parts of the lungs are the result of diffusion between it and the purer air of the bronchi, aided by the rush with which the tidal air flows in. The total amount of air inhaled daily by an average person at rest is estimated to be nearly 700,000 cubic inches, while if he is working the amount is of course much larger. This is a basis for the planning of the size and ventilation of schoolrooms and other public places.

The ordinary respiratory movements differ in the two sexes and at different periods of life. In young children the chest is altered in size chiefly by the movements of the diaphragm, and the protrusion of the abdominal wall during inspiration is therefore very marked. In men also it is the diaphragm which is chiefly operative, but the ribs are also moved. In women it is the movement of the ribs, especially the upper ones, which is the most extensive. The respiratory rhythm is the relation of the acts of inspiration and expiration to each other as regards time. See ANATOMY; BREATHING AND HEALTH; CIRCULATION; LUNGS, DISEASES OF; RESPIRATION.

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LUNGS, Diseases of. The disorders to to which the lungs of man are subject form a long list of maladies, involving numerous complications. Of these the more important will be considered here.

Congestion of the Lungs.—Pulmonary congestion (hyperæmia) may be active or passive. In the majority of cases active congestion is a symptom or a condition associated with bronchitis, pleurisy, pneumonia or tuberculosis. It may also be caused by the inhalation of irritating vapors. In rather rare instances it may result from violent exertion, or from drunkenness and exposure to great cold or heat, followed by œdema, possibly by death. As symptoms this primary congestion presents an initial chill, a cough, rapid breathing, frothy, blood-tinged expectoration, harsh respiration with fine moist râles, and absence of fever unless there is coexisting inflammation. The disease may last only a few days and is almost impossible to distinguish from an abortive pneumonia. Passive hyperæmia may be mechanical or hypostatic. Mechanical congestion is due to the presence of some obstruction to the return of the blood to the left side of the heart, such as emphysema or affections of the left ventricle, especially mitral narrowing or incompetency. Rarely it arises from pressure by tumors. The symptoms are cough, shortness of breath, blood-stained, frothy expectoration and possibly spitting of blood (hæmoptysis). Cases where there are intense dyspepsia, orthopnœa, coughing and cyanosis are known as cardiac asthma. Hypostatic congestion (settling of blood to the lowest parts of the lungs) occurs in conditions of great debility attended by feebleness of the heart, and is favored by prolonged lying upon the back. There is, however, an uncomplicated passive congestion which is hard to recognize as it produces no physical signs. It is, however, most common in long-continued typhoid fever, paralysis, prolonged unconsciousness, abdominal dropsy or tumors, and wasting diseases, especially tuberculosis and cancer. The physical signs are slight dullness over the bases of the lungs posteriorly, with weak or harsh and perhaps broncho-vesicular respiration, and moist râles.

Œdema of the Lungs.— This condition — an effusion of watery fluid (serum) from the capillaries into the air-cells and their walls — is almost invariably a sequel of congestion or inflammation of the lungs and is so frequently a concomitant of congestion that it is hard to tell them apart. It may be local, surrounding a circumscribed and usually inflammatory lesion; or general, due to causes in all respects similar to those which produce congestion. Pulmonary œdema occurs most commonly in connection with pneumonia, cancer, grave anæmias, Bright's disease, acute specific fevers with weak heart, valvular disease of the heart and apoplexy. The œdema may occur suddenly, especially in Bright's disease, for the reason that toxic matter which should have been excreted by the kidneys is thrown back upon the lungs which thus have to do a double duty. Usually its onset is gradual. The symptoms are increasing shortness of breath (dyspnœa), blueness (cyanosis) of fingers, lips and skin, cough and abundant watery, frothy, perhaps blood-stained, expectoration, without fever except from a causative inflammatory or febrile disease. The physical signs are slight dullness over the bases, and weak, perhaps broncho-vesicular, breath-sounds, with many unusually liquid large and small râles.

Embolism of the Lungs.— Foreign bodies (emboli) carried by the blood and lodging in the smaller arteries or capillaries of the lungs usually consist of disintegrated blood-clots (thrombi); less commonly of vegetations from diseased heart-valves, or masses of pathogenic germs. As a result of the cutting-off of the blood-supply to the lungs, circumscribed dark-red wedge-shaped areas of necrosis (hemorrhagic infarctions) occur, this is practically equivalent to saying that certain portions of the lungs are already dead. Emboli may be non-septic (not containing disease-germs), originating most commonly from chronic disease of the heart where the growths from the diseased heart break loose from it and are finally lodged in the lungs; or septic, arising from a gangrenous or suppurating focus in some part of the body. A non-septic infarct may in time be replaced by scar-tissue; if septic, abscess of gangrene of the lung may result. If the embolus is so large as to obstruct a main branch of the pulmonary artery, sudden death may take place. A complete stopping-up of a large blood-vessel always causes death. In occlusion of medium-sized branches there will be cough, spitting of blood, intense breathlessness, fainting, perhaps coma and convulsions. When the smallest branches are involved there may be slight cough, hæmoptysis and dyspnœa. The spitting of dark frothy blood during the course of chronic disease of the heart is particularly suggestive. If the infarction is very large the physical signs of a limited consolidation are present, followed, if the embolus is septic, by the evidences of pulmonary abscess or gangrene.

Pneumonia.— Two main varieties are recognized, lobar pneumonia and broncho-pneumonia.

Lobar Pneumonia.— This disease (called variously croupous pneumonia, pneumonitis, lung fever, inflammation of the lungs) is caused directly in the large majority of cases by the pneumococcus or *Diplococcus pneumoniæ* (or *lanceolatus*) of Fraenkel. Exposure to cold and wet, alcoholism and debility from pre-existing disease predispose, but it is an important fact that half or three-quarters of all normal people's mouths or throats contain the germ all the time. One attack renders a second more likely. Three stages are recognized in the pathological anatomy — congestion, red hepatization and gray hepatization. In the first stage the lung is deep-red, rather firm, does not collapse and the cut surface exudes a frothy, blood-stained, watery fluid. In the second stage the affected portion is dark-red, firm and sinks in water. It tears easily, the torn surface is granular and dry and the air-cells (alveoli) are filled with coagulated fibrin containing many red and some white blood-cells. In the third stage the color becomes a mottled gray and the cut surfaces are moist. The exudate in the alveoli undergoes softening and liquefaction and is either expectorated or carried away by the lymphatics.

The symptoms of a typical case begin abruptly with a severe shaking chill and a sharp stabbing pain in the side, followed by a quick rise of temperature to 105° F. or above. The breathing is rapid because the patient feels that deep breathing will excite the cough, varying from 40 to 60 or over, with an expiratory grunt and a dry, restrained and painful cough. The cough is generally present though not always and is one of the most painful symptoms, because it prevents sleep and accelerates exhaustion. The face is flushed, there is often a circumscribed redness on the cheek of the affected side and the nostrils dilate with each inspiration. A thick, tenacious, rusty or blood-stained expectoration appears. The pulse is rapid (100 to 120) and bounding. The tongue is coated, the bowels constipated, the urine scanty, high-colored, often slightly albuminous and as a rule strikingly deficient in chlorides. The lips are often bluish and present herpetic eruptions (cold-sores). Delirium is frequently manifest. In the majority of cases there is an increased number of white cells in the blood (leucocytosis), the count ranging from 12,000 to 50,000. The fever, having risen to its highest point (as a rule within 24 hours), remains high, with remissions, for from 5 to 10 days, when typically it falls (by crisis) within a few hours (5 to 12) to or below the normal.

Death may take place at any time during the disease. It is a very fatal malady in drunkards and in persons of 60 years or over (60 to 80 per cent); so also in infants under one year. Otherwise the younger the patient the better the outlook for recovery. The most common cause of a fatal result is the toxæmia (blood-poisoning) due to the products formed by the causative germ, and to the heart-weakness arising therefrom. Meningitis as a complication is always fatal. Unfavorable symptoms are the supervention of the «typhoid status,» very high fever (105° F. or over), marked cyanosis, severe dyspnœa, rapid extension of the disease to other lobes or to the opposite lung and increasing weakness of the heart with pulmonary œdema.

In some instances of recovery the consolidation may persist for from 8 to 10 weeks (delayed resolution), during which there is fever of a remittent type. In rare cases lobar pneumonia may terminate in abscess, gangrene or chronic fibrosis. Recurrences are frequent; third or fourth attacks are common and 8 to 10 have been reported. Relapses are rare.

Like other infections due to specific micro-organisms, lobar pneumonia may present striking variations both in symptoms and character. Thus the fever may be slight or entirely absent in old persons and chronic alcoholics. The crisis may be as early as the third day. The fever may terminate by a gradual fall instead of by a sudden fall, especially in children. There may be a false crisis two or three days previous to the final fall. The sputum may be of a red, rusty, yellow or dark-brown («prune-juice») color. Very seldom there is spitting of blood early in the disease. Pain is absent in deep-seated pneumonias when the pleura is not involved. In children the pain is usually referred to the abdomen; and abdominal pain, often severe, and generally due to involvement of the diaphragmatic pleura, is not uncommon in adults. An excessive amount of gas in intestines is by no means rare. The pulse may be small and rapid, or full but soft and followed by serious weakness of the heart. A persistent absence of leucocytosis is, except in mild cases, a symptom of bad omen. Convulsions often initiate the disease in children, and in them the symptoms may closely resemble those of meningitis. Deafness not depending upon inflammation of the middle ear is not infrequent. The delirium of lobar pneumonia, especially in drunkards, may be active or maniacal.

The variations in the character of the disease depend partly upon the site and extent of the local lesions, but mainly upon differences in the resisting power of the patient and the virulence of the pneumococcus. Among the atypical cases are those occurring in old persons. In them the disease is often latent, there is no chill and but slight cough or expectoration. The general prostration is marked, while the physical signs are indefinite or obscure. In infants and young children the disease frequently begins at the apex (top) of the lungs, the temperature is high and convulsions, delirium, stupor and coma are often prominent symptoms. Not infrequently vomiting and diarrhœa are so severe and persistent that the pneumonia may be overlooked. Typhoid pneumonia is characterized by muttering delirium, dry brown tongue, teeth covered with sordes, twitching of the tendons (*subsultus tendinum*), and perhaps picking at the bed-clothes or grasping at imagined objects in the air (*carphologia*)—symptoms resembling those which may appear in a severe attack of typhoid fever. In drunkards the disease may begin gradually, the fever may not be high, the delirium is commonly of the violent type and the typhoid status often develops, ending in death by exhaustion. The localization of pneumonia is variable. Most frequently the right lower lobe is attacked, and in double pneumonia both lower lobes are usually involved. When the consolidation steadily advances from lobe to lobe it is called wandering or migratory penumonia. Cases presenting delayed physical signs are very perplexing unless rusty sputum is present. The evidences of consolidation may not appear until the fifth or even the eighth day of the disease, a fact doubtless to be explained by the consolidation beginning in the centre of the lung and extending slowly to the surface.

Among the complications of lobar pneumonia, the most frequent is pleurisy, either serous or purulent (empyema). The ordinary dry pleurisy which covers the consolidated area, and which is responsible for the stabbing pain in pneumonia, cannot be considered a complication. When the pleurisy, however, is so severe and extensive that it rivals or surpasses the pneumonia element it constitutes pleuropneumonia. When a pleurisy follows pneumonia an irregular, perhaps slight, rise of temperature persists, the physical signs of fluid in the pleura become manifest and leucocytosis continues. Endocarditis, usually affecting the left side of the heart, is the next most frequent complication, and it may be of the ulcerative type. From 15 to 25 per cent of cases of the malignant form of the disease originate from pneumococcic infection. Symptoms are uncertain and sometimes absent. A prolonged irregular fever, with chills and sweating, is suspicious; if evidences of embolism occur and meningitis is present, together with the development of a loud diastolic murmur not previously found, the diagnosis of ulcerative endocarditis is assured. Pericarditis, usually fibrinous or serous, rarely purulent, occurs particularly in the double or left-side pneumonia of childhood. It is often latent or overlooked. Increased dyspnœa, weak pulse and præcordial pain may declare its presence. Meningitis, a very serious and fatal complication, is fortunately rare, and when occurring often coexists with malignant endocarditis. Marked cervical retraction, intense headache, delirium and coma indicate a basilar inflammation. Meningitis of the convexity is usually not recognized. Jaundice originating in the poisoning of the blood by the pnuemonia germ is very common in some epidemics of pneumonia. Middle-ear catarrh is not infrequent in children, parotitis is of occasional occurrence, so also are colitis and venous thrombosis. Pneumonia and malarial fever may either precede or occur during an attack of pneumonia. Redness, swelling and pain in one or more joints may become manifest during or after the crisis of a pneumonia and the inflammation proceed to suppuration. The pneumococcus is found in the diseased joints (pneumococcic arthritis).

The diagnosis of lobar pneumonia is as a rule readily made, most cases presenting distinctive and unmistakable symptoms. The disease may be overlooked in the very old or the very young, or in those already seriously ill. Hypostatic congestion can usually be distinguished from pneumonia by the absence of rusty sputum, or of fever, and is commonly bilateral. In pulmonary œdema, cardiac disease or nephritis usually coexist, and although dyspnœa, cough and expectoration are present, there is no fever, the breath sounds are weak, there are numerous fine and coarse liquid râles on both sides of the chest and marked dullness and bronchial respiration are absent. In œdema the sputum is fluid, frothy and not rusty. Acute bronchitis in children may simulate pneumonia, but there is no chill, convulsions, dullness or bronchial breathing, the fever is not so high as in pneumonia and there are dry and moist râles over both sides of the chest. Bronchopneumonia generally follows a bronchitis or an acute infection like measles. The fever is irregular, lasts for weeks and does not terminate by crisis. The sputum is streaked with blood rather than rusty. They physical signs consist mainly of dry and moist râles over both chests. If evidences of consolidation are found they lie in a vertical strip on both sides of the spine, while, on the other hand, in lobar pneumonia they are quite as well and often better perceived on the sides of the chest. Pleurisy with effusion is very rarely mistaken for pneumonia, except in children. In pleurisy there is seldom a chill, the fever is not so high and declines gradually, the cough is dry and there is no rusty sputum. The affected side is distended, vocal fremitus is absent, the line of dullness may shift as the patient is moved, the voice-sounds are absent or diminished, or there is egophony (a quavering quality of sound), and the respiratory murmur is absent or decreased. Bronchial breathing, if heard, is distant. The apex-beat may be displaced. Finally puncture affords proof positive of the presence of fluid. Acute pneumonic phthisis may exactly resemble lobar pneumonia until the 8th or 10th day, when the fever continues with profuse sweats and the signs of softening (gurgling râles, amphoric or cavernous breathing) gradually appear. The sputum becomes green and tubercle bacilli and elastic fibres are discovered in it. It may be impossible to distinguish between pneumonia presenting the typhoid status and typhoid fever complicated by pneumonia unless the case is seen from the outset, or rose-spots appear and a positive Widal reaction is present.

The treatment of lobar pneumonia involves careful attention to the details of nursing. The room should be especially well ventilated in order that the air of the chamber should contain the maximum natural percentage of oxygen. The freshest cold air that can be secured will aid the injured lung in doing its work as perfectly as possible. The patient is best kept on a roof or balcony except when it is necessary to expose some part of the body. Too much bed-clothing and the swathing of the trunk in cotton, both too often seen, tend to keep the fever higher than it would otherwise be, and add to the discomfort of the patient. If it is not possible to keep the patient in the open air, it may be necessary to administer oxygen, which is sometimes given for 20 minutes at a time, by means of a needle placed under the skin. Absolute rest in the recumbent position together with the use of the urinal and bed-pan is, with rare exceptions, to be insisted upon. The regular free giving of water is of great importance, although in some cases a glassful of water, where circulation is irregular, has been found too great a load upon it. The diet should be that usually given in fever, comprising milk, clear or diluted, flavored or not, perhaps peptonized, plain ice cream and junket; broths of beef, mutton, chicken, oysters or clams; tea, coffee or weak cocoa; grape or orange juice, lemonade, ginger-ale and fruit-ices; albumin water, egg lemonade; and if necessary one of the proprietary liquid foods. It is, however, very important that the patient should not be overfed, but that he should be given a diet as high in protein as he can stand. It has been found that milk, unless easily digested, may form curds which become quite dangerous. The medicinal treatment depends so much on the character of the individual case and the intensity of the special symptoms that it is not practicable to describe it here in detail. There is as yet no specific — a remedy which cures or tends to cure a particular disease — for lobar pneumonia. While some physicians have experimented with a serum in the treatment of this disease, it cannot yet be said that altogether satisfactory results have been obtained, possibly because of the fact that the pneumococcus contains no true toxin, as does the bacillus of, for example, diphtheria. Sodium salicylate and carbonate of creosote, the latter especially, have given apparent good results. One or two initial doses of quinine, say seven or eight grains of the sulphate, are highly recommended. An initial dose of calomel does good service. Side-pain is to be relieved, preferably by mustard poultices, or the ice-bag; if necessary by the smallest efficient doses of morphine or Dover's powder. The use of oxygen is desirable except in the milder cases. Delirium and restlessness may need the use of trional, veronal, bromides, chloral, camphor, hyoscine hydrobromate or morphine. For very high fever frictions with cold water are desirable. The cold tub may or may not be advisable, but its use is as a rule not to be commended. For weakness of the heart — the main channel through which life runs away in this disease — strychnine, caffeine, ammonia and wine or spirits are most useful. In addition may be required digitalis, nitroglycerine, sparteine, strophanthus, camphor and musk. Treatment and prophylaxis by vaccination have also been tried, but with unsatisfactory results.

Broncho-pneumona.— This (called also capillary bronchitis, lobular pneumonia, catarrhal pneumonia) is an inflammation of the terminal bronchi and their communicating air-cells, due to the presence of two or more varieties of micro-organisms. Those most commonly found are the *Pneumococcus lanceolatus, Streptococcus pyogenes, Staphylococcus aureus et albus,* and the germs of diphtheria and influenza (la grippe). It is noteworthy that the high mortality of the epidemic of Spanish influenza in the winter of 1918–19 was due largely to the secondary pneumonia which supervened in most of the cases. The disease may come suddenly during good health, or may be secondary to some pre-existent disease. It attacks especially the very young (under five), the very old or the debilitated of any age. It is most common among those who live in unsanitary surroundings. The primary cases are usually due to cold and exposure. The secondary cases follow acute bronchitis, measles, whooping-cough, diphtheria, scarlet fever, erysipelas and small-pox. They may succeed the inhalation of food or drink while the patient is unconscious; or operations on the mouth or nose; or any accident or disease which permits germ-containing particles to enter the bronchial tubes.

The pathology of the disease involves the presence of small areas of consolidation around the bronchioles and small patches of collapsed lung (which can be inflated) due to occlusion of the bronchi. The terminal bronchioles and the air-cells are filled with an exudate composed of leucocytes and degenerating epithelium. The bronchial walls also contain numbers of leucocytes. In the majority of instances both lungs are involved.

The symptoms, if the disease is primary, begin abruptly with a chill and a rapid rise of temperature, thus resembling lobar pneumonia. A low temperature, that is, not above 100° is an indication of low vitality in the patient. Of such patients about 75 per cent die. The best temperature indication is one which rises gradually to 103° or 104° and as gradually subsides. If on the other hand there are sharp rises and falls, pus is indicated and the prognosis is less favorable. If there is a pre-existing bronchitis of the larger tubes the onset is less abrupt and there is rarely a distinct chill. The characteristic symptoms are cough, dyspnœa, rapid respiration (40 to 80) with an expiratory moan, rapid pulse and perhaps cyanosis. A fatal result is to be expected if the cyanosis continues for more than a day or so. As the disease affects both lungs, the physical signs are bilateral. There are numerous sibilant and sonorous râles, at first and perhaps all through the disease, without evidences of consolidation. If areas of consolidation sufficiently numerous and confluent exist, there will be slight or even decided dullness, broncho-vesicular or bronchial respiration, and increased vocal fremitus and bronchophony. These signs are commonly found at the bases posteriorly and on either side of the spine.

The type of the disease varies. In certain cases (suffocative catarrh) the dyspnœa and cyanosis steadily increase, the cough lessens, the respirations become rapid and shallow, and the râles larger and moister. The patient is drowsy but restless, and death ensues from weakness and overdistention of the right ventricle. The fever in some instances, especially in children, may be of a remittent type and lead to a mistaken diagnosis of malaria. The primary form in infants and young children sets in abruptly with chill and high fever and bears a close resemblance to lobar pneumonia; in adults it may begin like a severe acute bronchitis, but the fever, cough and dyspnœa are more marked than in a bronchitis and the sputum is tenacious and rusty. The secondary form begins as a bronchitis, often of slow development, with increase in the fever of the primary disease (for example, measles), cough, dyspnœa and rapid breathing.

The duration is variable. Cases of great severity, especially in children, may prove fatal in from three to six days; the common type ending in recovery endures from one to three weeks; exceptionally the disease may be protracted to six or eight weeks, rarely even to 10 or 12 weeks. Death may occur at any time. The fever gradually declines.

In the diagnosis of the disease the cardinal symptoms are fever, cough, dyspnœa, rapid respiration and bilateral physical signs. Its differential diagnosis from lobar pneumonia has been stated in the description of the latter disease. From the broncho-pneumonic form of pulmonary tuberculosis the distinction may be extremely difficult. A tuberculosis family history, progressive emanciation, the finding of tubercle bacilli in the sputum and the occurrence of the signs of softening, will declare for tuberculosis.

With regard to the prognosis, it is to be remembered that broncho-pneumonia is always a grave disease. The primary cases usually recover; the fatality is greatest in the secondary forms. In children among the well-to-do the mortality varies from 10 to 30 per cent; in hospitals and among the very poor, from 30 to 70 per cent. Inhalation broncho-pneumonia is usually fatal because of its frequent termination in abscess or gangrene.

Concerning treatment, the utmost importance should be attached to prophylaxis, for instance, the prevention of the spread of an ordinary bronchitis of the larger tubes to the terminal bronchi, especially in children. Perhaps the most important measure of prevention is to keep the patient in an even temperature of 68° to 70° F. during the day and about 10 degrees colder at night and to avoid all depressing agencies, as overfatigue, improper food, etc. The disease, having declared itself, requires in the main the same management as a lobar pneumonia. Opiates, however, should rarely be employed. Local counter-irritation of the chest, poultices, wet compresses and frictions with stimulating liniments constitute a much more important element of the treatment than in lobar pneumonia; so also perhaps do the so-called expectorants, such as the ammonium preparations. If the child is unable to expel accumulated mucus the use of an emetic (ipecac, alum) may be desirable.

Pneumonoconiosis.— This is a chronic pneumonia due to the inhalation of dusts incident to various employments, and giving rise to anthracosis, or coal-miner's disease; chalicosis, stone-cutter's phthisis, or grinder's rot; siderosis, caused by the inhalation of metallic particles by metal-workers; and there is a fourth form of dust associated with disease, viz., the organic dust caused in flour milling, in the manufacture of tobacco and of various textiles. There is much evidence of late, however, that the particles of dust never reach the lungs, and that the dust diseases of the lungs are caused by pathogenic germs which are swallowed. The symptoms and signs are those of chronic bronchitis with emphysema and fibroid changes. In the later stages the lungs may become tuberculous. The prognosis is favorable in the early stages upon quitting the obnoxious work; in advanced cases grave, although the disease is essentially chronic. Dust diseases are best controlled by prophylactic measures, among which appropriate legislation is of the utmost importance.

Atelectasis.— Collapse of the lungs — partial or entire disappearance of air from the air-cells — may be congenital, occurring in the new-born as a result of weakness or some form of obstruction in the air passages. The acquired variety is due variously to obstruction of the smaller bronchi by mucus; to compression of the lung by large effusions or tumors in the chest; to respiratory paralysis; or to great abdominal distention. It is sometimes a result of whooping cough.

Emphysema.— The lungs in this disease contain an abnormal amount of air. The common form — hypertrophic emphysema — is characterized pathologically by distention of the air-cells and thinning of their walls. The lungs are large, pale and do not collapse. Many of the pulmonary capillaries are obliterated, thereby causing obstruction in the pulmonary circulation with compensatory hypertrophy of the right ventricle.

The predisposing cause is a congenital weakness of the lung structure; the exciting cause is increased intrapulmonary tension due variously to chronic or severe cough, heavy lifting, glass-blowing or using wind-instruments.

The symptoms come on insidiously, often in early life. These are dyspnœa, perhaps only on exertion; cough, ultimately becoming chronic; frequent attacks of bronchitis or spasmodic asthma, and cyanosis, with subnormal temperature and cool skin.

When the right ventricle fails there are swellings of the feet and other evidences of general venous congestion. The physical signs are usually distinctive. Inspection shows the short broad barrel-shaped chest of emphysema, with its vertical movement, poor expansion and prolonged expiratory motion. Usually there is a marked epigastric pulsation. The apex-beat is not seen. The percussion note is hyper-resonant, even slightly tympanitic. The normal limits of pulmonary resonance are extended in every direction. The characteristic auscultatory finding is that of a low-pitched, often wheezy, greatly prolonged expiratory sound. The inspiration is short and weak. Bronchitic râles, at times in great frequency, are often heard.

The course of the disease is essentially progressive and chronic. It is incurable, although the patient may live to old age. Death may occur from intercurrent pneumonia or phthisis, or from heart failure.

The treatment is that of chronic bronchitis (q.v.). When practicable, the subject should live in a warm equable climate in order to avoid recurrent acute bronchitis. The bowels should be kept regular, and the diet carefully supervised to avoid abdominal distention. Inhalations of oxygens and appropriate treatment by compressed and rarified air may be helpful. Strychnine, iron and digitalis are of much service when judiciously employed; so also are the arsenic and iodine compounds.

Abscess of the Lung.— An acute suppurative inflammation caused by pus-producing organisms. The pus collections may be single or multiple. The organisms may reach the lung by way of the bronchi, as in an inhalation pneumonia, or by infective emboli (see EMBOLISM), or by direct extension, as from a purulent pleurisy. Very rarely it is a sequel of an ordinary broncho-pneumonia or lobar pneumonia.

The symptoms are chills, high and irregular fever, sweats and leucocytosis. In time the physical signs of cavity are manifest. The sputum is yellow or green, of an offensive, but not putrid, odor, and contains particles of lung tissue and elastic fibres.

The prognosis is usually hopeless. There are occasional recoveries in the cases following pneumonia (except of the inhalation type), or the penetration of external abscesses into the lung. If the abscess is single and accessible, operation may be successful.

Gangrene of the Lung.— A result of infection of a necrotic portion of lung by the bacteria of putrefaction, conjoined with an abnormal vulnerability of the tissues. Diabetes and long continued fevers predispose; pneumonia (particularly inhalation-pneumonia), tuberculous cavities, new growths, embolism and abscess are the most frequent antecedent conditions.

The symptoms are irregular, generally moderate, fever, with rapid pulse, cough, dyspnœa and prostration. The physical signs, when present, are those of cavity. The characteristic symptom is the excessively fetid odor of the breath and sputum. The latter contains fragments of lung tissue, elastic tissue, blood pigment and numerous bacteria. If allowed to stand the sputum separates into three layers — the uppermost frothy, the middle watery, the lower with a heavy greenish-brown sediment.

The prognosis in the majority of cases is bad. Small, strictly circumscribed areas may become encapsulated, the broken down tissue discharging by way of the bronchi. In accessible cavities surgical interference may succeed.

New Growths in the Lung.— The most common forms are carcinoma and sarcoma, usually bilateral and secondary to cancer elsewhere. Associated lesions are pleurisy, enlargement of the tracheal, bronchial and cervical glands; perhaps also pulmonary gangrene. The symptoms may be latent. Ultimately cough, pain and dyspnœa appear. The physical signs are variable, depending largely upon the presence or absence of pleural effusion. According to the size and location of the growth, pressure symptoms will be present, for example, hoarseness from pressure on the recurrent laryngeal nerve; or distention of the veins and swelling of the face, neck and arms from the pressure of the growth on the venous trunks in the chest.

The diagnosis depends largely upon the presence of malignant growths elsewhere, or upon the history of the previous removal of such growths. The disease ends fatally with a duration varying from six weeks to two years. It has been found that 9 per cent of cancers, whether in the lung or in the pleura, may be operated upon, and while the successful operations have not been many, some progress has been made along a path only recently traversed in surgery. See also CONSUMPTION; CONSUMPTION, PREVENTION OF.

GLENTWORTH REEVE BUTLER, M.D.,
Author of 'Diagnostics of Internal Medicine.'

LUNGWORT. The name of several plants supposed to have medicinal value in respect to diseases of the lungs. One is a lichen (*Sticta pulmonacea*) growing on the trunks of trees in moist subalpine regions. In Siberia it is used as a substitute for hops. Other such plants belong to a genus of borages (*Pulmonaria*). The narrow-leaved lungwort is *P. angustifolia*, and the common lungwort *P. officinalis;* the former is wild. These are European; but an American borage, the blue-blossomed Virginia cow-slip (*Mertensia virginica*), is called lungwort in the Southern States and used by compounders of simples. A near relative is the sea-lungwort (*Mertensia maritima*). Another lungwort is one of the hawkweeds (*Hieracium pulmonarium*). Bullock's or cow's lungwort is the common mullein (*Verbascum thapsus*).

LUNN, George Richard, American legislator: b. Lenox, Iowa, 23 June 1873. He was graduated at Bellevue College 1897 and in 1901 at the Union Theological Seminary, in 1901 he was ordained to the Presbyterian ministry and from 1901 to 1904 was associate pastor of the Lafayette Avenue Church, Brooklyn, from 1904 to 1909 of the First Dutch Reformed Church of Schenectady, N. Y., and since 1909 of the United People's Church of the same city. In 1912–14 Mr. Lunn was mayor of Schenectady, the first Socialist mayor elected in New York State. He was re-elected for the term 1 Jan. 1916 to 31 Dec. 1917 and in 1917–19 was Member of Congress from the 30th New York district. His administration in Schenectady was marked by great efficiency and by many much-needed reforms. As Member of Congress Mr. Lunn was one of the foremost and most progressive members of the House.

LUNN HEMP. See FIBRE.

LUNT, Orrington, American merchant and philanthropist: b. Bowdoinham, Me., 24 Dec.

1815; d. Chicago, 6 April 1897. After working in his father's store he was made partner at 21, but removed (1842) to Chicago, where he carried on a general commission business, starting in the grain trade in 1844 to become wealthy by 1862, when he retired and traveled, to regain his lost health, through Europe and Asia for two years. For some years then he was president and treasurer of the board of waterworks at Chicago and was elected (1855). director of the Galena and Chicago Union Railroad. He founded the Northwestern University and established the Orrington Hunt Library Fund. From the organization of the university he was its secretary and treasurer and for many years acting president of the executive board, being made its president in 1895. Among the numerous other philanthropic works in which he became deeply and actively interested was the Garrett Biblical Institute, which he founded; the Chicago Orphan Asylum, the Relief and Aid Society of Chicago, etc.

LUPERCALIA, lū-pėr-kā'lĭ-ạ, an ancient Roman festival celebrated annually in honor of Lupercus, an ancient pastoral god of the Italians, afterward identified with the Arcadian Pan, who protected the flocks against wolves and gave them fertility. The festival dates from the earliest period of the history of Rome; it was held on the Lupercal, where Romulus and Remus were supposed to have been nurtured by a she-wolf. The day of celebration was 15 February, which was originally the last month of the Roman year.

LUPINE, a genus of annual and perennial herbs and a few shrubs (*Lupinus*) of the family *Fabaceæ*. The species, of which there are about 100, are sparsely represented in the Mediterranean region and in the eastern United States, but very numerous in the Western and Pacific Coast States. They have usually digitate leaves; pea-like showy blue, yellow or white flowers in terminal racemes, and flattened pods containing several large seeds. Several of the species have been long used for forage, for human food and for green manuring. Many others are grown for ornament. They thrive especially well upon light, dry soils deficient in lime, and are said to fail upon wet and limy soils. They are readily propagated by means of seed, or the perennials by division, but these cannot be satisfactorily transplanted when once established. The most important species are the blue lupine (*L. hirsutus*), the white lupine (*L. albus*) and the yellow lupine (*L. luteus*), all of Old World origin. The plants are rich in nitrogenous matter and are thus especially useful for stock-food as well as green manure. Like clover, peas and beans they can obtain free nitrogen from the air by means of their root tubercles. The ripe seeds are rich in proteid substances and but for their bitter principle would probably be more popular as human food than they are even in Europe, where their consumption is enormous. The bitterness may be removed by long soaking in water. In America, though gaining in popularity as soil improvers and forage crops, the plants are seldom grown except for ornament.

LUPOT, lü'pō, **Nicolas**, most famous of French violin makers: b. Stuttgart, 1758; d. Paris, 1824. He was one of the third generation of a family of well-known violin makers and has been called the «French Stradivarius.» He produced fine instruments quite early in his career, as those made by him at Orléans (Rue d'Illiers) before his 20th year are considered bargains now in Paris at 500 francs. He moved to Paris in 1794, setting up shop (1798–1803) at Rue de Grammont, next removing to Rue Croix des Petits Champs, at which place he produced the famous Italian copies. He favored the Stradivarius form for his copies, but made some instruments on Guarnerius lines. His autograph was placed on many of his creations or copies. One of his *tours-de-force* was the making of several quintets of two violins, two tenors and a bass, aiming at giving them true unity of tone and appearance. They are highly prized and priced by connoisseurs. From 1,000 to 1,200 francs is considered a low price for any of his instruments dated between 1805 and 1824, 'cellos fetching as high as 2,000 francs. Experts claim his weakest point to have been his varnish, which is usually thick, semi-opaque and lumpy.

LUPUS, a generic term used to describe several varieties of chronic localized infiltrations of the skin. The most common of these are *Lupus erythematosus* and *Lupus vulgaris*. The former occurs in slightly elevated, scaly, red patches, varying in size, which show a strong tendency to the production of atrophic scars. It is most common on the face, ears and scalp, more rarely occurring on the hands and feet. It begins in several isolated or grouped red spots little larger than a pin-head and having a thin scale. These spots increase in size by peripheral extension, while the surface is partly covered by the grayish scales or thin scar tissue. The color is characteristic and is violaceous. They may remain small, or may grow large enough to cover the side of the face. Practically nothing is known of the etiology. The comparatively small patches have little effect on health, but the disseminated variety may cause death.

Lupus vulgaris is a chronic disease of the skin, due to its invasion by the tubercle-bacillus; characterized by one or more brownish-red lumps or patches that tend to absorption, ulceration and scar formation. The disease usually begins in childhood, the most frequent site being the face, particularly the cheek and nose. There may be one or more such spots, but they show no tendency to symmetrical development. After a time slightly scaly patches will form by the coalescence of the tiny red spots. Sometimes the disease has a slow course, for years remaining quiescent; in other cases it suddenly takes on a rapid growth. The erythematous form is treated by superficial caustics. *Lupus vulgaris* being a tubercular disease, hygiene is of great importance, and the X-rays and other powerful rays seem to exert a curative influence on the growths.

LURAY, lū-rā', Va., town, county-seat of Page County, on the Norfolk and Western Railroad, about 100 miles north by west of Richmond and the same distance west by south of Washington. It is situated in a beautiful valley almost surrounded by mountains; nearby are a number of mineral springs and the celebrated Luray Cave (q.v.). A spring which flows through the town furnishes water power. It manufactures flour, lumber, wagons, carriages and some agricultural implements. It has a distillery and a large tannery, also canneries and woodworking plants. The Luray College for Young Ladies is located here. The waterworks are the property of the municipality. Pop. 1,218.

LURAY CAVE, in Page County, Va., is near the town of Luray, and on the Norfolk and Western Railroad. This cave was discovered by Andrew J. Campbell and companions in August 1878. It is in the limestone belt of the Shenandoah Valley, on the western side of the Blue Ridge, and extends under the low spurs of some of the mountains. The area explored underlies about 100 acres. Electric lights have been installed, and they enable one to see the numerous stalactites, the tiers of galleries, nearly 300 feet in height, the various rooms or cavities, the colors from white to yellow, brown and red, and the marks which indicate the action of water for ages. Many of the columns are over 50 feet in height and are hollow; when struck they give out bell-like notes. Many people visit this cave each year.

LURGAN, lŭr'găn, Ireland, town in the county of Armagh, 15 miles by rail to Armagh. It has a handsome parish church, Roman Catholic chapel, college, courthouse, bridewell, workhouse, three banks, etc. Here are located great manufactures of linen cambrics, muslins, damasks, lawns, etc., and its weekly market has an important trade in agricultural products. Pop. about 12,553.

LURIA, loo'rē-ạ, **Isaac Ben Solomon,** Jewish mystic: b. Jerusalem, 1534; d. Safed, 1572. He was called «Ashkenazi» (the German) on account of his descent. He received a thorough education and in 1559 became a spice merchant in Cairo, trading under the name of Isaac Luria. He contracted an early marriage the while continuing his studies. After two years of married life he went into seclusion to study the ‘Zohar,’ the Kabbalistic Bible. Luria claimed to have received visits from Elijah during his meditations, in the course of which he built up a mystic system of great beauty. In 1566 he went to Safed where he became the centre of a group of disciples of his mystic cult and where he was held in great esteem by the populace, being commonly reputed a miracle worker. Luria wrote nothing but Hayyim Vital collected much oral material from his disciples from which he produced several works including the famous ‘Ez Hayyim’ (6 vols., 1784). See JEWS AND JUDAISM — THE CABALA.

LURTON, Horace Harmon, American jurist: b. Newport, Ky., 26 Feb. 1844; d. 12 July 1914. He entered (1859) Douglas University, Chicago, but on the outbreak of the Civil War enlisted in a Tennessee regiment. Ill health caused his discharge (1862) when he had been serving as sergeant-major. Later he took part in the battle of Fort Donelson where he was taken prisoner but escaped and served during the «Morgan raid» to be again captured in Ohio, remaining a prisoner till the end of the war. He next studied law at Cumberland University, Lebanon, Tenn., where he was graduated in 1867. Practising law at Clarksville under different auspices and partners he became (1875) chancellor of the sixth chancery division of Tennessee. In 1886 he was elected justice of the Supreme Court of Tennessee and, in 1893, was made chief justice. Two months later President Cleveland appointed him circuit judge of the sixth United States Judicial Circuit. In these later offices he had shown remarkable juridical talent, acting on the lines of human justice backed by courage. In 1898 he accepted from Vanderbilt University the chair of professor of constitutional law, retaining it till 1910, when President Taft appointed him associate justice of the Supreme Court.

LUSHAIS, loo-shīz, a people native to the eastern border of Bengal, in Assam and Upper Burma, living in the little explored, wooded hills. They are divided into several clans under chieftains and have an organized military system. Those who have become more or less subjected to English rule are often called Kuki («hill-men»). The men are tall, strong and well-built; the women, aided by wooden or ivory discs, draw their upper lips to wonderful size. All work is done by the women but they are held in some respect. These natives are brave hunters, herd cattle, sheep and swine and make cotton textiles, weave baskets, etc. They were continually making looting raids on British settlements but were subjected to influence at last in 1872. Their religion appears to extend to devotional exercises in time of trouble, to immediately fall into disuse when prospering. They are nature worshippers. Consult Lewin, ‘Wild Races of South Eastern India’ (London 1870); Soppit, C. A., ‘Short Account of the Kuki Lushai Tribes on the Northeast Frontier’ (1887).

LUSIADS, The. ‘The Lusiads’ (‘Os Lusiadas’) by Camoens (Luis de Camões, 1524 or 1525–1580), published in 1572, is the great Portuguese national epic and is by far the outstanding masterpiece of Portuguese literature, as also one of the great epics of the modern world. More than possibly any other epic it may be called national in that the poet's attempt is to picture the great glory of his people, the pleasantness and beauty of his native land and the generous deeds of her princes on land and sea. It is an epic in 10 cantos containing altogether 1,102 eight-line stanzas of the same verse form as Ariosto's ‘Orlando Furioso.’ Even more striking than the Italian model is the influence of Virgil in the celestial machinery of the poem and the frequent reference to classical mythology. The poem is, however, by no means imitative; for the fundamental conception and its working out are vigorous and original. Unlike the ‘Æneid,’ it deals not with the exploits of one hero, but with the Portuguese nation.

The story is told, however, through the person of an immediate hero, Vasco da Gama, and it deals with his great voyage of 1497–98 to India. After a spirited and serious invocation of 18 stanzas, the expedition is described as well on its way. Meanwhile the gods and goddesses of Olympus are holding conclave to determine the fate of the adventurers. The chief disputants are Venus, who was much affected toward the Portuguese, and Bacchus, who feared that, should the Portuguese succeed in reaching India, his renowned name would be «buried in the dark vase of the water of oblivion.» Venus prevails, and the Portuguese are hospitably received at Mozambique and Mombasa and other towns on the east coast of Africa. At Melinde, Vasco da Gama, in the third and fourth cantos of the epic, relates the story of the Portuguese nation from the time of the hero, Viriatus, and the Lusitanian shepherds, who fought against the power of Rome, through the stirring days of Aljubarotta, down to the voyage to India. Most of the deeds are martial, as the account of the heroism of Alfonso Henriques, the sacrifice of Egas Moniz and the chastising of the Saracens by Sancho. The loveliest and best-known episode is the tale of Inez de Castro. The famous story shows the gentle, more pathetic side of the poem, the tenderness of the poet for his native land. The stanzas in which da Gama relates the leavetaking at Lisbon show with impressive dignity the sadness of such a scene, and the old man who addresses his warning from the sea-shore typifies the spirit of the Portuguese people who, like other unambitious folk, are unable to see good of such lust for fame and glory.

In the fifth canto, da Gama continues his narrative, confining himself to the story of the voyage. Escaping from various snares of the natives, they double the Cape of Storms (now the Cape of Good Hope). The tempestuousness of the sea and the savage aspect of the land is personified to the mariners by the giant Adamastor. This derelict Titan, incorporated forever in the rocky headland, rails at them as they pass and foretells the unending series of disasters which shall follow them and other mariners from their audacious voyage. The sultan of Melinde, pleased with the story and the martial aspect of the Portuguese, dismisses them with pilots to show the way to India. Bacchus, however, has not done with them. He succeeded in persuading Æolus and Neptune to harry them between Melinde and Calicut. Their journey is beguiled by half-legendary tales of Portuguese honor or of Portuguese adventure, and they reach Calicut in safety.

The seventh and eighth cantos tell what happened in India. The ruler of Calicut gives them leave to trade and visit, and his wonder at the armament of the Portuguese, and his curiosity with regard to their banners and ensigns, gives Paulo da Gama an opportunity to recount the warlike deeds of his countrymen. This he does in spirited language and with no repetitions of the story told by his brother at Melinde. The nabob, however, is corrupted by Bacchus, with the result that the Portuguese have a narrow escape from treachery. Then the fleet, well laden with merchandise, explores the coast further to the east and finally turns back toward Lisbon.

In the last cantos Venus, well pleased with the success of her beloved race, places in their path the Isle of Love, where the ships anchor and where the crews receive joyous welcome. The song of a siren foretells the future of a glorious nation, and the goddess Tethys, leading Vasco da Gama to the top of a high mountain, points out the lands of the earth and prophesies the share that the Portuguese shall have in them, naming to him the great men who shall follow and make worthy his discovery. There follows the closing address to the unfortunate king, Dom Sebastian, in a passage of great dignity, earnestness and patriotism, a fitting close of a great poem.

The management of the poem evidently rests on an anachronism: the constant use of pagan and classical gods furnishes the movement of the epic, while at the same time the facts are those which the poet has observed for himself or taken from history, and the morality and religion are contemporary. The episodes, however, are combined with unusual skill, and serve to show a complete and general picture of the spirit which animated the nation. Altogether the poem is, as Hallam said, the first successful attempt in modern Europe to construct an epic poem on the ancient model and it is also the work of a man in whom the love of the fatherland was unfailing.

In style, the epic is regarded by native critics as the best model in the language. At its best, it is direct, reserved, swinging, sometimes brilliantly emphatic; at its worst, prolix and without humor. Like the Portuguese style, it is accumulative,— that is, it works by massings and repetitions, rather than by swift epigram, terseness, spontaneity and the single phrase.

The influence of 'The Lusiads' has been great in Portugal and elsewhere. In Portugal it was followed by many epics dealing with the deeds of the Portuguese, of which the 'Lisboa Edificada' of Gabriel Pereira de Castro and the 'Naufragio da Sepulveda' by Jeronymo de Cortereal are good examples. The epic period lasted for 30 or 40 years in Portugal, and the form has had several recurrences both in Portugal and Brazil in the 18th and the 19th centuries. Outside of Portugal, 'The Lusiads' has been translated over 80 times into as many as 15 different languages. There are at least nine published versions in English, ranging from that of Sir Richard Fanshaw in 1665, to that of Sir Richard Burton in 1880, the most ambitious and sympathetic of all. The most accurate translation in almost all respects, the best for the reader who wishes to follow the Portuguese with an almost line for line English version, is that of J. J. Aubertin. The reader should refer to the Visconde de Juromenha's 'Vida de Luis de Camões' (in Vol. I of the authorized edition of the 'Obras'); to Theophilo Braga's 'Historia de Camões'; to Oliveira Martin's 'Camões, Os Lusiadas e a Renascença em Portugal'; and, in English, to Sir R. F. Burton's 'Camoens: his Life and his Lusiads.'

William T. Brewster.

LUSITANIA, lū-sĭ-tā'nĭ-ą, Spain, the name of an ancient region of Hispania, the boundaries of which appear to have varied at different times: (1) on south by the Tagus and the ocean on the north and west; (2) bounded on the north by the Douro; (3) one of the three provinces in which Augustus divided the Iberian Peninsula, and lying south of the Tagus. The inhabitants were warlike and brave, lived upon plunder and were rude and unpolished in their manners. The Romans had great difficulty in conquering them, being frequently defeated by Viriathus, chief of the Lusitanians, who was captured by treachery and put to death, about 140 B.C., Lusitania shortly afterward coming under Roman control.

LUSITANIA, British Cunard liner, torpedoed and sunk by a German submarine 10 miles off Old Head of Kinsale, on the southwestern coast of Ireland, at 2.05 P.M. on Friday, 7 May 1915. The *Lusitania* was built by the firm of John Brown and Company and launched on 7 June 1906, at Clydebank. The length of the vessel was 785 feet; breadth, 88 feet; depth to the boat-deck, 80 feet; maximum draught, 37 feet, and a height to the mast-head of 216 feet; gross tonnage, 40,000. She was fitted to carry 2,800 passengers, besides the crew. The *Lusitania* and her sister ship the *Mauretania* were built by the Cunard Steamship Company under special agreement with — and subsidized by — the British government. The fundamental condition of that agreement was that the vessel should be «capable of maintaining a minimum average ocean speed of from 24 to 25 knots in moderate weather.» Fulfilment of that condition restored to the British that supremacy of speed on the Transatlantic service («the blue ribbon») which had passed to the Germans some years before. Fitted with turbine engines, at her speed test the vessel averaged 25.35 knots over a 24-hour run. The maiden voyage, from Liverpool to New York, was made in September 1907, and in November the vessel established a record by making the journey from Fastnet to New York in 4 days, 18 hours, 40 minutes. The cost of the *Luisitania* was about $9,000,000; depreciation, maintenance and other charges were estimated at about $150,000 a month, and the expenses of each voyage to New York and back was approximately $150,000. During the first nine months of the war the vessel crossed the ocean with almost her accustomed regularity. On 6 Feb. 1915 the *Lusitania* arrived at Liverpool flying the American flag and with a number of American passengers aboard. The German submarine «blockade» of the British Isles opened on 18 Feb. 1915. On 1 May, the day the *Lusitania* was scheduled to sail from New York, an advertisement appeared in the leading journals of the United States emanating from the German embassy at Washington warning Americans against traveling on British ships. The *Lusitania* left New York on that day, commanded by Captain W. H. Turner, with a crew of over 600 and 1,250 passengers, among them 188 Americans. Her cargo was valued at $740,000, and consisted of copper articles, brass, furs and small-arms cartridges, but no guns, high explosives nor loaded shells. The vessel was not armed. She sank in about 21 minutes after being struck by the first torpedo. The total death roll amounted to 1,154 (755 of them being passengers, of whom 114 were Americans, and in addition there were 35 infants). The German claim that the *Lusitania* carried guns was disproved by American officials of the port of New York who inspected the ship before her departure. The Federal District Court of New York, in a decision written by Judge J. M. Mayer and filed 24 Aug. 1918, held that the vessel was unarmed and carried no explosives of any kind (*Current History*, New York, October 1918). As a result of the tragedy, a diplomatic controversy developed between the United States and Germany. See WAR, EUROPEAN.

LUSK, Graham, American physiologist: b. Bridgeport, Conn., 15 Feb. 1866. He was graduated (1887) at Columbia University, studied at Munich and was appointed (1891) instructor of physiology at Yale University, then successively assistant professor (1892–95), and professor (1895–98). He was (1898–1909) professor of physiology at the University and Bellevue Hospital College, and professor of physiology at Cornell University Medical College, New York, from 1909. He has acted as scientific director to Russell Sage Institute of Pathology and has written 'Elements of the Science of Nutrition' (1906); 'The Fundamental Basis of Nutrition' (1914), besides contributing to numerous scientific journals.

LUSK, William Thompson, American physician: b. Norwich, Conn., 23 May 1838; d. New York, 12 June 1897. He entered Yale in 1855 but failing sight caused him to leave in a year for treatment of the eyes in Europe. He next (1858) took up the study of medicine at Heidelberg and after two years studied at Berlin for one year. On his return to America he served (1861–63) in the army, going to the front on the staff of Gen. I. I. Stevens, and (1863) resigned at request to take command of a regiment recruiting in New York City, but accepting instead the appointment of adjutant-general, with rank of captain, under Gen. Daniel Tyler. He was cited for conspicuous gallantry on several occasions. Resigning in 1863 he entered Bellevue Medical College, New York City, where he was graduated. After studying in Europe he settled at Bridgeport, Conn., and practised medicine (1865–66), then removed to New York City. From 1869–71 he was professor of physiology and microscopic anatomy at Long Island Medical College, delivering lectures at Harvard Medical School. In 1871 he accepted the chair of obstetrics and diseases of women at Bellevue Hospital Medical College which he held till his death. In his latter years he was coeditor with Dr. James B. Hunter of the *New York Medical Journal*. Among his many works he wrote 'Science and Art of Midwifery' (5th ed., 1897), which has been translated into many languages.

LUSKA, Sidney. See HARLAND, HENRY.

LUSTRATION, in ancient Rome, a ceremony of solemn purification or consecration of the Roman people, by means of an expiatory sacrifice, which was performed after every census. The sacrifice consisted of a bull, a sow and a sheep or ram. The ram was dedicated to Jupiter, the swine to Ceres and the bull to Mars. As this lustration took place at the end of every five years, *lustrum* came to signify a period of five years.

LUTE, a stringed musical instrument formerly much in use. It originally contained six strings, but the number was gradually increased till it reached 24. The lute consists of four parts, namely, the table; the body, constructed of nine convex ribs; the neck, which has as many frets or divisions; and the head or cross, in which the screws for tuning it are inserted. In playing this instrument the performer strikes the strings with the fingers of the right hand, and regulates the sounds with those of the left. The notes of the lute are generally written on six lines, and not on five. There were formerly various kinds in use.

LUTETIA. See PARIS.

LUTHER, Martin, German religious reformer: b. Eisleben, Saxony, 10 Nov. 1483;

d. there, 18 Feb. 1546. Hans Luther, his father, a miner in very humble circumstances, removed with his family to Mansfeld in 1484, and in the course of time was appointed to a seat in the council. Martin was educated in the deepest respect for religion, and under the severest discipline, his parents practising the most austere lives of virtue and piety. At 14 he was sent to the school at Magdeburg, whence he removed in 1499 to Eisenach. At first he obtained his support by singing songs at the door like many other poor scholars; but was soon taken under the care of a benevolent lady named Ursula Cotta. At school he made rapid progress in Latin and in other studies; in 1501 he entered the University of Erfurt, where his mental ability soon won him distinction among his fellows. In 1505 he received the degree of master. He was orginally destined by his father for the law, but circumstances at this time turned his attention to religious truth, and he began the study of divinity. Then to the surprise and regret of his father came the young man's «great renunciation» and his determination to enter the monastery of the Augustines at Erfurt in 1505. Luther regarded himself as an unprofitable servant, tortured himself with bitter reproaches and was attacked by a severe fit of sickness, during which one of the elder brothers consoled him and promised him the forgiveness of his sins through faith in Jesus Christ, a doctrine which Luther afterward declared brought a new light into his soul. He was also much encouraged by Staupitz, the provincial of the Order, who perceived his great talents and encouraged him to continue his theological studies. Staupitz himself had a singularly clear gospel conception of the cardinal doctrines of faith, repentance, the love and holiness of God, and it is no doubt true that Luther owed much of his «insight» into truth and the opportunity to give it expression to the kindly vicar-general. It is also well to remember in considering the life and work of Luther that some of his best and most cherished works — the Epistles to the Romans and the Galatians, his edition of Tauler's ‹Theologia Germanica,› and the exposition of the Seven Penitential Psalms were conceived while he was a member of his Order; as late as 1516 even, the year before his renunciation, he emphasized in a sermon the cardinal principle, «The Church cannot err in proclaiming the faith, only the individual within her is liable to error.»

In 1507 he was ordained priest, and in 1508, by the influence of Staupitz, Luther was called by Frederick of Saxony to the chair of philosophy at the newly-founded University of Wittenberg. He lectured on the Aristotelian philosophy at the university as well as in the monastery, and at the same time began his activity as a preacher. In 1510 he made a journey to Rome on business of his order. In 1512 he took the degree of doctor of theology. It was shortly after this, in 1514, that Leo X issued a bull, granting an indulgence to all who should contribute to the rebuilding of Saint Peter's Church at Rome. Tetzel, a Dominican friar, was chosen by the cardinal archbishop of Mainz, who, jointly with the guardian of the Franciscan friars, was named commissary of the indulgence for Saxony and the north of Germany, to preach the indulgence through this district. It was the preaching of Tetzel which was the occasion of the beginning of the Reformation. Tetzel was preaching at Juterbogk, a few miles from Wittenberg, when, on the eve of All Saints' day, 31 Oct. 1517, Luther affixed his 95 theses to the door of the Scholsskirche, challenging the Dominican friar. Though carefully guarded in their wording, Luther's propositions were clearly contrary, in some respects, to the current doctrine. The sixth thesis denied the power of the keys, and maintained that the Pope can only *declare* a sin to be forgiven by God; the 36th, that through true contrition a Christian is freed from all guilt and punishment; the 66th spoke not of abuses, but said of indulgences in general that they were nets to catch money with; but the 71st declared anathema. to him who would reject indulgences altogether. It is clear that Luther at this time had no conception of the Reformation as a movement in opposition to the Catholic Church, nor any idea of denying the supremacy of the chair of Saint Peter, but was worked into a fury by abuses which he thought the ecclesiastical authorities were not sufficiently active in regulating, and his zeal carried him to the breaking point with the ancient Church. His propositions were condemned as heretical as soon as they appeared. Hoogstraaten, a Dominican of Cologne, Eck at Ingolstadt, and Prierias, an officer of the Roman court, immediately made replies to his theses; but neither argument, invective, the summons to Rome, which he did not obey, nor the mild counsels of Cardinal Cajetan at Augsburg in 1518, and of the nuncio Militz at Altenburg in 1519, were sufficient to induce him to recant. His replies were made with great boldness and determination, and even after his dispute with Eck at Leipzig in 1519, he still maintained the invalidity of indulgences and of the supremacy of the Pope. He appealed from the decision of Cardinal Cajetan to the Pope, and from the Pope to a general council.

In the year 1519, at Leipzig, occurred the famous public disputation between Luther and Carlstadt on the one side and Eck on the other, upon the questions at issue. The result was barren. Both sides claimed the victory and the contestants parted unchanged in their respective attitudes. The Leipzig disputation only precipitated a long and bitter controversy, and Luther remained as determined in his opposition as ever. Militz tried once more to make peace, and met Luther for a second time at Liebenwerde. But the conference was again without fruit. Luther's position had now grown more and more radical, though as yet there was no formal, complete and definite rupture with Rome. The controversy by this time had spread throughout all Germany, and princes and people were arrayed in bitter factions over the issue. Early in 1520 Luther appealed to Charles V, who had succeeded the Emperor Maximilian. He also addressed letters to the bishops of Mainz and Merseburg to enlist them in his cause. The bishop of Mainz, in his reply, treated the questions at issue as of a trivial and frivolous character, and the bishop of Merseburg repudiates Luther's position and exhorts him to submit. Among his friends at this time were Willibad Pirkheimer and Albrecht Dürer, though they did not follow him when the formal break with Rome came. Ulrich Von Hutten encouraged and urged him

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forward. Franz von Sickingen and Sylvester von Schaumberg declared their readiness to put a number of armed knights in the field for him, should it be necessary. Two notable books now appeared from Luther's pen defining his attitude: 'To the Christian Nobility of the German Nation,' and the 'Babylonian Captivity.' In the former he proclaims the universal priesthood and declares against any especially instituted priestly order. He also contests the right of the Pope to interpret the Bible, which he declares to be free to everybody. He likewise inveighs against the Pope's exclusive right to summon a general council. In the 'Babylonian Captivity' he altogether repudiates the doctrine of indulgences, holds that the papacy is nothing but Babylon, and reduces the sacraments to three only — «Baptism, Penance, and Bread.» The latter work was in preparation when the bull of excommunication against Luther arrived in Germany.

The attitude of Luther was more and more one of outspoken opposition to the Pope and to the doctrines of the Church itself, and so far had his opposition now advanced that the Roman authorities decided to proceed to extreme measures to crush it. In October 1520, therefore, the memorable bull excommunicating Luther and his friends was published at Leipzig. His writings were burned at Rome, Cologne and Louvain. The answer to the papal bull was characteristic of Luther. At Wittenberg, 10 Dec. 1520, he burned the bull of excommunication and the decretals of the papal canon. By this act he dissolved all connection with the Pope and the Roman Catholic Church. Frederick, the elector of Saxony, doubted whether he should protect him. But the German noblemen, Hutten, Sickingen, Schaumburg, whom he called upon to defend the new opinions, hailed him as the champion of religious liberty and offered him the protection of their fortresses and their arms. On 28 January Charles V opened the Diet of Worms and commanded Frederick to bring Luther with him to appear before that body to answer for his conduct. Frederick demurred, on the plea of his fear for the safety of his protégé. When, however, Luther's opinion was asked, he declared that he was ready to appear, and that not even illness would hold him back. In the meantime Charles had revoked his command in order to allow the 60 days to pass granted by the bull of excommunication. Another papal bull was issued, however, after the burning of the first, in which Luther was definitely declared a heretic, and an interdict put upon all places harboring him. Summoned a second time, before the Diet, he expressed his willingness, if he were granted a safe conduct, which was accorded him by the emperor. He was met by about 2,000 persons on foot and on horseback at the distance of a league from Worms. When the palatine sent a messenger to warn him of his danger he answered, «If there were as many devils in Worms as there are tiles upon the roofs of its houses I would go on.» Before the emperor, the Archduke Ferdinand, 6 electors, 24 dukes, 7 margraves, 30 bishops and prelates and many princes, counts, lords and ambassadors, Luther appeared, 17 April, in the Imperial Diet, acknowledged all his writings, and on the following day made his defense before the assembly. The conclusion of his speech has been transmitted from generation to generation as follows: «Let me then be refuted and convinced by the testimony of the Scriptures or by the clearest arguments, otherwise I cannot and will not recant, for it is neither safe nor expedient to act against conscience. Here I take my stand; I can do no otherwise, so help me God! Amen.» Whether or not this is historically correct (and its form is certainly very doubtful) makes little difference: the fact is beyond question that he did stand firm and refuse to yield or recant. Frederick the Wise conveyed him privately to the Wartburg to save his life. Luther took advantage of this retirement to translate the New Testament into German. But this seclusion continued only 10 months. When informed of the disturbances excited by Carlstadt on the subject of images he could no longer endure restraint, notwithstanding the new outlawry which the emperor had issued against him at Nuremberg; and at the risk of provoking the displeasure of the elector he hastened to Wittenberg through the territory of George, Duke of Saxony, who was one of his most bitter enemies. The sermons which he delivered for eight successive days after his return (in March 1522) to quell the violence of the enraged insurgents in Wittenberg are patterns of vigorous and popular eloquence.

Amidst these disputes and attacks his plans for a total reformation of the Church were matured. In 1523 at Wittenberg he began to revise the liturgy, and in 1524 laid aside his cowl. In 1525 Luther married Katharina von Bora, who some years previously had left the cloister and joined the reformed religion. He prepared, from 1526 to 1529, a new church service, corresponding to his ideas of the doctrines of the gospel, under the patronage of the elector and with the aid of Melanchthon (q.v.) and other members of the Saxony Church. His larger and smaller catechisms, to be used in schools, were also of great service. An unsuccessful effort was made in 1529 at Marburg, in a conference between Luther and Zwingli, the Swiss reformer, to bring the German and Swiss movements into harmony. But Luther's peremptory refusal to accept Zwingli's views upon the question of the Lord's Supper precluded any possibility of agreement. The Reformation (q.v.) spread rapidly, and the Augsburg Confession, the earliest symbol of Lutheran Protestantism, was drafted by Melanchthon from articles prepared by Luther. During all these years he waged a ceaseless polemic against Rome, and made strenuous efforts to establish harmony among German Protestants. The intolerance which he manifested toward the Swiss reformers, because their views differed from his own in regard to the Lord's Supper, shows that he was not yet ready to grant that liberty to others which he demanded for himself. He was in this matter the chief cause of the separation which took place between the Calvinists and the Lutherans. The rapidity with which the Reformation advanced after the Confession of Augsburg in 1530 rendered the papal bulls and the imperial edicts against Luther ineffectual. In 1537 Luther wrote the Schmalkaldic articles; he gave no heed to the ambassadors of Brandenburg and Anhalt, who were sent in 1541 by the Diet of Ratisbon to make him more submissive to the Church, and in 1545 he refused to participate in the Council of Trent.

In his controversies with his foes and opponents Luther's spirit was oftentimes savage. biting, coarse, displaying almost uncontrollable anger and sometimes unjustifiable hatred. The occasional asperity which he showed in the defense of his faith, however, by no means diminished the merit of his constancy; and an apology may easily be found for the frequent rudeness and coarseness of his expressions in the prevailing mode of thinking and speaking; in the nature of his undertaking which required continual conflict; in the provocations by which he was perpetually assailed; in his frequent sickness; and in his excitable imagination, evident from the days of his novitiate. The same excitability of temperament will serve to explain those dreadful temptations of the devil which disquieted him. That age regarded the devil with horror as a personage ever active; and those devoted to the cause of God felt themselves constantly obliged to resist attacks of the evil one. Luther himself says, «I was born to fight with devils and factions. This is the reason that my books are so boisterous and stormy. It is my business to remove obstructions, to cut down thorns, to fill up quagmires, and to open and make straight the paths; but if I must necessarily have some failing let me rather speak the truth with too great severity than once act the hypocrite and conceal the truth.» No one can behold without astonishment his unwearied activity and zeal. The work of translating the Bible, which might well occupy a whole life, he completed, with some assistance from Melanchthon and other friends, between 1521 and 1534. This translation takes the same place in Germany as the King James version does in England and the United States with regard to the religious life and literature of the people. Luther equaled the most prolific authors in the number of his treatises on the most important doctrines of his creed. After the year 1512 he preached several times every week, and at certain periods every day; he officiated at the confessional and at the altar; he carried on an extensive correspondence in Latin and German on various subjects with men of rank and of distinguished literary attainments and with his private friends. He gave advice and assistance wherever it was needed and interested himself on behalf of every indigent person who applied to him. In company he was lively, and abounded in sallies of wit and humor preserved in his 'Tischreden' ('Table-Talk'). Luther was no stranger to the elegant arts. His excellent hymns such as 'Ein' feste Burg,' 'Aus tiefer Noth,' are well known. His fondness of music, too, was such that he would often relax his mind with composition, with singing and playing on the flute and lute. Luther kept up his tremendous activities until the close of his life. Just before his last journey to Eisleben, where he was summoned by the Count of Mansfeld to settle a dispute, he wrote in a letter to a friend the following description of his condition: «Aged, worn out, weary, spiritless, and now blind of one eye, I long for a little rest and quietness; yet I have as much to do in writing and preaching and acting as if I had never written or preached or acted. I am weary of the world, and the world is weary of me: the parting will be easy, like that of a guest leaving the inn; I pray only that God will be gracious to me in my last hour, and I shall quit the world without reluctance.» His wife died in 1552.

The 400th anniversary of the birth of Luther was commemorated with special observances throughout Protestant countries in the year 1883. The Tercentennial Commemoration of the Reformation begun by Luther at Wittenberg, on All Saints' Eve, 31 Oct. 1517, had been celebrated in 1817, and the Protestant world had been looking forward with increasing anticipation to the Quadricentennial Commemoration in 1917. The event, however, was overshadowed by the Great World War which had been raging for three years from August 1914. Nevertheless the event had wide, if subdued, recognition in many countries. As expressed by a prominent New York Lutheran divine, «Without any spirit of hostility to the Roman Catholic Church, but with a cheerful recognition of its conscientious devotion and labor of love and sacrifice for the cause of Christ. . . . the idea of the observance is to study the causes, the necessity and the generic truths of that epochal event, so as to emphasize anew their vital significance. It is done out of fealty to the word of God and with the conviction that the principles enunciated by the reformers are essential to a true church, and to a scriptural Christianity.» From Wittenberg, on the anniversary day, 31 Oct. 1917, rejecting peace proposals, the German Evangelical League, however, launched a manifesto in which militant sayings of Luther were forcibly applied to the current events of the war. It read in part as follows, «We especially warn against the heresy promulgated from America that Christianity enjoins democratic institutions, and that they are an essential condition for the establishment of the kingdom of God on earth. As Luther said, 'The freedom of a Christian does not depend on forms of government; these are shaped by historical developments and the accumulated experience of nations.'» The Quadricentennial Commemoration gave rise to a great quantity of magazine literature, Protestant and Catholic, on the influence of Luther on modern history, which may be studied with advantage as throwing greater light on the civilizing trend of the four centuries since Luther's inception of the Reformation, and the remarkable Catholic revival known as the Counter-Reformation. Consult Butler, N. M., in 'Celebrating 400 years of Protestantism' from *New York Times,* 23 Sept. 1917; and for further articles 'Luther, Martin,' and 'Reformation' (in *Cumulative Index of Periodical Literature,* New York 1917), and *New York Times Index* (New York 1917); also bibliography attached to this article.

No great historic character has been more of a «problem» to friend and foe alike than Luther. Historians without number have utterly failed rightly to understand or satisfactorily to interpret the reformer and his strenuous and eventful life. No man has been more violently assailed, and none has had warmer defenders. He has been pictured as an inspired personality, an extraordinary genius, a national hero, the «prophet of a new religious point of view and the creator of a new ethical ideal»; the chosen of God; the deliverer of the Church; the champion of conscience and individual freedom; the creator of a national literature; and again he has been bitterly assailed as a raving monk; a barbarous writer and demagogue; a child of the devil; the insane monk; a corrupt and shameless sensualist; false to his vows and hypocritical and deceitful in his life. For this reason the writer has endeavored to limit this sketch simply to a faithful and suggestive outline of the history of Luther's life, believing that a fuller understanding must be sought in the larger study afforded by extended sources relating to the man, and the time and nature of his activities. See CHRISTIAN DOCTRINE, DEVELOPMENT OF; REFORMATION; COUNTER-REFORMATION; and related references.

Bibliography.— Luther's works are partly in German, partly in Latin. Of earlier editions the most complete is that by Walch (1740–53); and of later, the Erlangen-Frankfort editions (German writings 1826–57; Latin writings 1829–86); and that published at Weimar (1883 et seq.). There are separate collections of his letters and his table-talk. Of accounts of his life may be mentioned those by Meurer (3d ed., 1870); Köstlin, J. (4th ed., 1889), English translation (1883); and Peter Bayne (1887). Consult also Beard, 'Martin Luther and His Reformation in Germany'; Tulloch, 'Leaders of the Reformation'; Lindsay, 'Luther and the German Reformation' (1900); McGiffert, A. C., 'Martin Luther: The Man and His Work' (New York 1911); Böhmer, H., 'Luther in Light of Recent Research' (New York 1916). For Roman Catholic view of Luther, consult Evers, M., 'M. Luther, Lebens und Charakterbild' (1883–91); Verres, 'Luther' (1884); Janssen, 'History of the German People' (1900), 'Luther and His Protestant Biographers' (in *American Catholic Quarterly Review*, pp. 582–601, New York 1901).

GEORGE EDWIN RINES.

LUTHER COLLEGE, situated at Decorah, Iowa. It was founded in 1861 under the auspices of the Synod of the Norwegian Lutheran Church in America. There is a preparatory department, besides the regular collegiate department. The degree of A.B. is conferred. In 1916 the value of the productive funds was $279,000; the annual income amounted to $35,000; the library contained 26,000 volumes. The students numbered 207 and the faculty 17. For boys only. President, Rev. Christian Keyser Preus. Total number of graduates up to and including 1916, 697.

LUTHER LEAGUE OF AMERICA, The, a society organized in 1895 at Pittsburgh, Pa., with the object of linking together the Lutheran young people who are laboring for the good of the Church by means of many individual societies of various names and styles of organization, each within its own immediate church. The constitution declares that its objects shall be "to encourage the formation of the young people's societies in all Lutheran congregations in America, to urge their affiliation with their respective State or Territorial leagues, and with this league to stimulate the various young people's societies to greater Christian activity and to foster the spirit of loyalty to the Church." The fundamental principles are federation and co-operation, and it is non-synodical in character. The total membership is over 100,000. These are comprised in 25 States, 14 of which already have permanent State organizations, and five foreign countries. A monthly journal, *The Lutheran League Review*, is published in New York. Consult the 'Luther League Handbook' (New York) and Bacon and Northrop, 'Young People's Societies' (ib. 1900).

LUTHERAN CHURCH IN AMERICA.

Early History.— The first Lutherans in America came from Holland during the Thirty Years' War on account of religious oppression, and settled in the colony of New Netherlands. The exact year of their arrival is not known; some seem to have come with the very first settlers in 1623, but they are mentioned in 1643 as living in Manhattan (New Amsterdam—New York). A congregation was established in 1648. The recognized religion of the colony being strict Calvinism, the Lutherans were treated very harshly, especially by the governor, Peter Stuyvesant. Their children had to be brought to Calvinistic preachers for baptism, and they were fined and imprisoned even for holding informal services for the reading of the Bible. They applied to their home church for a pastor of their own faith and John Ernest Gutwasser (Goetwater) was sent them in 1657, but was sent back by the authorities in 1659. They obtained religious freedom only with the capture of the city by the English in 1664. In the following years ministers were sent to them from Amsterdam, Holland, but sometimes long vacancies occurred, and they were obliged to apply to the Lutheran Swedes on the Delaware for spiritual ministration. Prominent among their ministers in the 18th century was the German, Justus Falckner (1703–23), the first Lutheran minister ordained in America, who also served the Lutherans on both sides of the Hudson as far up as Albany; W. C. Berkenmeyer, also a German, and M. Knoll. Gradually the congregations turned from the Dutch to the German and English languages.

Distinctively Lutheran settlements were made by the Swedes along the Delaware, where Wilmington is now situated, beginning with 1638. Reorus Torkillus was their first pastor. He was succeeded by John Campanius, who was the first to begin mission work among the North American Indians, and who translated Luther's Catechism into the Delaware language. His labors enabled William Penn, in after years, to carry out his pacific policy toward the Indians. Campanius also dedicated the first Lutheran church in the new world on the island of Tinicum, near Philadelphia. As most of the Swedish pastors returned to Sweden after some years, and as the Swedish was replaced by the English language, the congregations gradually fell away from their mother church and entered into communion with those of the Protestant Episcopal Church.

The great influx of German Lutherans took place in the first half of the 18th century, after the first German colony, under the leadership of Pastorius, had arrived in 1683 and founded Germantown, now a part of Philadelphia. In Germantown the first German Lutheran service was conducted in 1694 by Rev. H. B. Koester, and in Falckner's Swamp (New Hanover, Pa.), near Philadelphia, the first German Lutheran church was in existence in 1704. This first German Lutheran congregation was served by Daniel Falckner, the older brother of Justus Falckner. In New York the leader of the immigrants was Joshua Kocherthal, a Lutheran minister from the Palatinate, arriving on New Year's day 1701. The Palatinate had been ravaged with fire and sword under Louis XIV of France, the inhabitants were obliged to flee in order to save their lives and many of these fugitives found a temporary refuge in England, where Queen Anne arranged for their emigration to America. In 1710 not less than 11 ships came to New York carrying some 3,000 immigrants. They settled in the Catskill Hills on the banks of the Hudson; later on many of them went westward and moved into the Schoharie Valley. All were served by the indefatigable and faithful Kocherthal. In 1734 the Lutheran Salzburgers, driven from their homes in Austria through persecution, settled in Georgia not far from Savannah. Their settlement was named Ebenezer, and their pastors were Bolzius and Gronau. Gradually groups of German Lutherans were found along the whole Atlantic Coast. In Pennsylvania alone some 60,000 Lutherans were settled about the year 1750, for whose spiritual wants there was, at first, no adequate provision. Several of these Pennsylvania congregations joined in sending a delegation to London (Court-chaplain Ziegenhagen), and to Halle in Germany (Prof. A. H. Francke), representing the needs of the immigrants and asking for able clergymen. These negotiations finally resulted in the coming to America of Henry Melchior Muehlenberg, the pious and indefatigable so-called «patriarch of the Lutheran Church in America.» He arrived in 1742, served the congregations that had called him, organized new congregations far and wide, built churches (Saint Michael's, Philadelphia) and in every possible way was active for the Church. He was followed by a number of educated and faithful men from Germany (Kurtz, Kunze and others), and thus an era of great activity began among the scattered Lutheran churches; their number being continually increased through the coming of more immigrants, and the Lutheran Church attaining considerable influence.

Synodical Organizations.— One of the most important things done by Muehlenberg was the founding of the first Lutheran synod in America, the still existing «Evangelical Lutheran Ministerium of Pennsylvania and adjacent States.» It took place 26 Aug. 1748, and German and Swedish pastors participated in the organization. Before Muehlenberg's death (1787) the second Lutheran synod was organized through the efforts of his son, Rev. F. A. C. Muehlenberg, and his son-in-law, Rev. J. C. Kunze (1786), and in the following decades other bodies were formed: the North Carolina Synod (the mother of all the southern synods), in 1803; the synod of Ohio in 1818; the Tennessee Synod in 1820. Throughout the 19th century such synodical organization took place, partly in consequence of branching off from the older synods, sometimes also in opposition to them, but chiefly on account of the rapid and remarkable expansion of the Church through the coming of immigrants from Europe, especially to the Western States. The entire number of synods now in existence is 62. The internal condition of the Church, however, in the closing years of the 18th and in the first decades of the 19th century, was not a good one. The ravages of two wars left their marks; the problem of transition from German to English worship was not always solved in the right way; but above all the rationalistic and unionistic tendencies in the European churches bore their fruits also in America and left the Lutheran Church in a deplorable state of desolation. The founding of the Missouri Synod (Evangelical Lutheran Synod of Missouri, Ohio and other States) in Chicago, 26 April 1847, had a most significant influence on the external and internal development of the Lutheran Church in the United States. In 1839 a colony of Saxon Lutherans numbering about 700 souls had come to America, having left their native land on account of the bad condition of their home church, showing itself in the opposition to the Lutheran Confessions and the prevalence of rationalism, and had settled in Saint Louis and in Perry County, Mo. Their leader was Martin Stephen and with him came a number of earnest and devout pastors and candidates. When their leader was found to be a deceiver he was excommunicated, and C. F. W. Walther, one of those younger pastors, a man of remarkable ability as theologian, preacher, author and church organizer, came to the front. In 1844 he began to edit the semimonthly church paper *Der Lutheraner*, which rapidly became the organ for confessional Lutheranism. About the same time Pastor F. Wyneken had come to America and had spent some years in serving the scattered Lutherans in Indiana and Michigan. Not being able to take care of the great number of them he returned to Germany and interested the home churches in the work. Especially Pastor W. Loehe of Neuendettelsau, Bavaria, took a very active part in preparing and sending ministers to America; and these three parties, the Saxon immigrants (Walther, Loeber, Keyl, Fuerbringer and others), the Loehian pastors (Sihler, Craemer and others) and Wyneken, combined and organized the Missouri Synod, which has ever stood for strict confessionalism and through its testimony has had decided influence for good upon the whole Lutheran Church, also in foreign countries, although it severed all connection with the German state churches and upholds and emphasizes the principle of absolute separation of church and state. Through the untiring labors of its pastors in home mission work, and through the attention given to the training of the young in parish schools, it has become by far the largest Lutheran synod in America, consisting at present of 23 district synods and extending over practically every State of the Union, to Canada and even to Brazil and Argentina. About the same time (1839) another band of German Lutherans had left Prussia on account of the Prussian Church Union between the Lutheran and Reformed churches (1817) and under the leadership of J. A. Grabau organized the Buffalo Synod in 1845. Some years later (1854) the Iowa Synod was founded, also by German missionaries sent by Loehe, after the Missourians and Loehe had parted on account of doctrinal differences. Finally, the Scandinavian Lutherans must be mentioned. Even before the middle of the 19th century a tide of

Scandinavian immigration had set in, leading in the course of time to synodical organization. The most prominent was the Norwegian Evangelical Lutheran Synod of North America, founded in 1853 by H. A. Preus, J. A. Ottesen and others. A controversy on the doctrine of predestination led to a separation and to the forming of the United Norwegian Lutheran Church in America, in 1890. Prior to this the Norwegian Hauge Synod had been organized through the influence of E. Eielsen, originally a lay preacher and adherent of Hauge, a theologian of pietistic tendency. The largest Swedish Lutheran body, the Augustana Synod, was founded in 1860. Besides these, the Danes, Finns and Icelanders have their own synods. The Slovak Evangelical Augsburg Confession Synod, organized in 1902, is in sympathy with the Missouri Synod.

General Bodies.— Most of the 62 Lutheran synods in the United States are combined in larger «general organizations.» The oldest of these is the General Synod of the Evangelical Lutheran Church in the United States of America, formed in 1820 through the efforts of the Pennsylvania ministerium, at that time the largest Lutheran synod in America. The General Synod aimed at a union of all Lutherans, but, when the Pennsylvania Synod withdrew in 1823, it comprised for some years only a number of smaller English synods. Gradually it grew, the Pennsylvania Synod again united with it and in 1860 it embraced 26 synods. However, during the Civil War the synods south of the Potomac withdrew, and in 1866 the Pennsylvania Synod again severed its connection on account of the liberal and unionistic standpoint of the general body. The General Synod had formally declared that it stood on common ground with the Union Church of Germany and did not consider the distinctive doctrines separating the Lutheran and Reformed churches essential. It was more intent on fraternal relations with other denominations than on union with Lutherans of strict confessional principles. (S. S. Schmucker and the «Definite Platform»). The withdrawal of the Pennsylvania Synod soon led to the organization of the General Council of the Evangelical Lutheran Church in North America in Fort Wayne, Ind., 20 Nov. 1867, under the leadership of C. P. Krauth, C. F. Schaeffer, G. F. Krotel, W. J. Mann and others. The confessional basis was stated to be the doctrines of the Unaltered Augsburg Confession in its original sense. A number of Lutheran synods, English and German, joined this General Council, also the Swedish Augustana Synod, not, however, the Missouri Synod, nor the Ohio Synod, because the General Council, though more confessional than the General Synod, did not take a definite standpoint on the so-called «four points»: chiliasm, altar and pulpit fellowship, and secret societies. The Iowa Synod maintained a friendly attitude toward the General Council, but did not join it. In 1872 the Evangelical Synodical Conference of North America was formed by the Missouri Synod, the Ohio Synod, the Wisconsin Synod (founded in 1849 by Muehlhaeuser and others, joined the General Council, but withdrew in 1869), the Minnesota Synod (founded in 1860, joined the General Council, but withdrew in 1871), the Illinois Synod and the Norwegian Synod. It was founded on a strict confessional basis as laid down in the Lutheran Confessions, and became at once the largest general organization in America; and although the Ohio Synod left this general body in 1881 on account of a controversy over the doctrines of election and conversion, and also the Norwegian Synod severed its connection in 1883 on account of internal troubles, the Synodical Conference is still the largest general body. In 1886 the Southern synods which had withdrawn from the General Synod at the time of the Civil War formed a new general body, The United Synod of the Evangelical Lutheran Church in the South, comprising eight smaller synods. The jubilee year of the Lutheran Reformation (1917) developed two important combinations. The three Norwegian synods mentioned above joined and formed the Norwegian Lutheran Church of America; and the General Synod, now more confessional than formerly, the General Council, and the United Synod in the South took action and formed a union called The United Lutheran Church in America, which action was formally ratified 15 Nov. 1918. The synods of Wisconsin, Minnesota and Michigan, which had formed what may be called a general organization in 1892, have rearranged their organization into a general body consisting of six district synods, but retaining their membership in the Synodical Conference.

Church Polity.—According to Lutheran principles the congregation is the unit of church organization, the source of all authority exercised by the Church and the final court of appeal. Congregations combine and organize themselves into synods for conducting the Church work on a larger scale and for the sake of mutual assistance and oversight; but the synods have no power except that which the congregations confer upon them; they are purely advisory bodies. It must be said, however, that while these principles are conceded by most Lutheran organizations, not all bodies conform to them in practice, some of them outside of the Synodical Conference allowing synods a greater power and placing greater weight upon their decisions.

Church Worship.— Because the Lutheran churches in Europe always had great diversity in their forms of public worship the Lutheran Church of America shows no uniformity in this respect, the different bodies having at first followed the usages of their mother churches to a greater or less degree. However, a greater uniformity has been brought about since the so-called «Common Service,» based upon the consensus of the Lutheran liturgies of the 16th century, was prepared by a committee representing the General Synod, the General Council, and the United Synod in the South. This form of service is used also by a number of congregations in other Lutheran bodies, especially after they had introduced the English language in their services.

Church Work.—All the church bodies named are very active in various forms of educational, missionary and benevolent work. They maintain a high standard of ministerial education and have founded a large number of theological seminaries. They have their own colleges and academies preparing their men for the theological courses and giving a general education. They prosecute intensively home mission work, conducting such work also among the Indians and negroes in the United States, and maintain foreign mission fields in the different parts of the globe. The American Lutheran Church is indeed a polyglot church proclaiming the gospel in no less than 20 languages. All of the larger bodies have their own publishing houses for the printing of their church papers and the dissemination of Lutheran literature. The statistics of 1917 report 27 theological seminaries, the largest among them being Concordia Seminary at Saint Louis, Mo. (Missouri Synod, 344 students); Concordia Seminary at Springfield, Ill. (Missouri Synod, 127 students); Augustana Seminary at Rock Island, Ill. (Augustana Synod, 101 students); Norwegian Seminaries, combined in 1917, at Saint Paul, Minn. (88 students); Lutheran Seminary at Mount Airy, Philadelphia (General Council, 58 students); Lutheran Seminary at Maywood, Chicago (General Council, 52 students); Wartburg Seminary at Dubuque, Iowa (Iowa Synod, 48 students); Lutheran Seminary at Wauwatosa, Milwaukee, Wis. (Wisconsin Synod, 42 students); Wittenberg Seminary at Springfield, Ohio (General Synod, 38 students); Lutheran Seminary at Columbus, Ohio (Ohio Synod, 38 students); Theological Seminary at Gettysburg, Pa. (General Synod, 34 students); Luther Seminary at Saint Paul, Minn. (Ohio Synod, 30 students). The number of Lutheran colleges in 1917 was 41; of academies 58, a number of them coeducational; of ladies' colleges 7. The General Synod conducts foreign mission work in India and Liberia; the General Council in India, Burma, Japan; the Missouri Synod in India and China; the different Scandinavian bodies in India, China, Natal, Madagascar; the Ohio Synod in India. Missions among the American Indians are conducted by the Scandinavians, the Missouri Synod and the Wisconsin Synod; among the negroes by the Synodical Conference and by the Ohio Synod. The statistics for 1917 enumerate 66 orphanages, 46 homes for the aged, 7 homes for defectives, 9 deaconess mother-houses, 50 hospitals, 18 immigrant and seamen's missions, 12 miscellaneous institutions, 13 home finding and children's friend societies. There are 13 official Lutheran publishing houses, the more important ones being located in Philadelphia (General Synod and General Council); Saint Louis (Missouri Synod); Rock Island (Augustana Synod); Minneapolis (Norwegian Synod); Chicago (Iowa Synod); Columbus, Ohio (Ohio Synod); Milwaukee (Wisconsin Synod); Columbia, S. C. (United Synod in the South). The number of Lutheran periodicals goes well into the hundreds.

General Statistics.— The Lutheran Church is the fourth largest denomination in the United States coming after the Roman Catholics, Methodists and Baptists. The statistics herewith given are obtained from official sources and are published in the 'Lutheran Church Year Book' for 1918. The several bodies are arranged according to the year of their organization. The latest developments in the organization of general bodies mentioned above must not be overlooked in the following tables.

General Synod—1820	Organized	Ministers	Congregations	Communicant Members
Synod of Maryland	1820	115	131	36,335
Synod of West Pennsylvania	1825	93	158	38,783
East Ohio Synod	1836	53	72	12,909
Allegheny Synod	1842	72	153	25,730
Synod of East Pennsylvania	1842	145	150	43,266
Synod of Miami	1844	44	54	10,686
Pittsburgh Synod	1845	90	125	26,711
Wittenberg Synod	1847	59	78	17,318
Olive Branch Synod	1848	34	48	7,342
Synod of Northern Illinois	1850	55	61	12,496
Synod of Central Pennsylvania	1853	50	92	12,598
Synod of Iowa	1855	36	32	5,465
Synod of Northern Indiana	1855	46	73	9,679
Synod of Central Illinois	1867	25	31	4,955
Susquehanna Synod	1867	52	81	20,320
Synod of Kansas	1868	44	46	6,362
Synod of Nebraska	1871	49	54	8,544
Wartburg Synod	1876	48	52	10,030
Synod of California	1891	42	30	5,346
Rocky Mountain Synod	1891	24	23	2,139
German Synod of Nebraska	1891	90	115	10,439
Synod of Southern Illinois	1900	11	17	2,172
Synod of New York	1908	146	143	30,142
Synod of West Virginia	1912	15	38	4,305
Total—24 Synods	....	1,438	1,857	364,072
General Council—1867				
Ministerium of Pennsylvania	1748	408	580	161,486
Ministerium of New York	1773	157	155	56,795
Pittsburgh Synod	1843	157	192	37,631
Texas Synod	1851	9	14	1,171
District Synod of Ohio	1857	55	92	15,151
Augustana Synod	1860	720	1,225	191,390
Lutheran Synod of Canada	1861	42	74	14,410
Chicago Synod	1871	50	64	8,753
English Synod of the Northwest	1891	45	53	12,372
Manitoba Synod	1897	31	58	4,760
Pacific Synod	1901	20	24	1,849
Synod of New York and New England	1902	65	56	21,367
Nova Scotia Synod	1903	8	26	3,029
Synod of Central Canada	1909	12	16	1,813
Total—14 Synods	....	1,779	2,631	531,978
Synodical Conference—1872				
Synod of Missouri, Ohio and other States	1847	2,743	3,094	598,777
Synod of Wisconsin	1850	315	362	155,261
Minnesota	1860	48	75	26,319
Michigan	1860	43	58	12,121
Nebraska	1904	22	21	5,969
Slovak Synod	1902	30	79	8,570
Total—6 Synods	....	3,201	3,689	807,017
United Synod—1886				
Synod of North Carolina	1803	51	76	10,782
Tennessee Synod	1820	56	135	13,820
Synod of South Carolina	1824	53	75	10,648
Synod of Virginia	1829	30	58	6,858
Synod of Southwestern Virginia	1842	29	70	4,850
Mississippi Synod	1855	6	10	552
Synod of Georgia	1860	22	31	3,861
Holston Synod	1861	10	29	1,855
Total—8 Synods	....	257	484	53,226
Independent Synods				
Joint Synod of Ohio and other States	1818	685	916	138,542
Buffalo Synod	1845	36	49	7,395
Eielsen's Synod (Norwegian)	1846	6	26	1,232
Synod of Iowa and other States	1854	576	1,056	125,458
Danish Lutheran Church	1871	74	112	14,463
Icelandic Synod	1885	16	55	4,598
Suomi Synod (Finnish)	1890	40	151	16,511
United Danish Lutheran Church	1896	143	185	14,996
Lutheran Free Church (Norwegian)	1897	198	420	20,536
Norwegian Lutheran Church of America	1917	1,247	3,378	300,000
Other bodies and independent tongregations	....	92	257	33,925
Total—10 Synods	....	3,113	6,605	692,119
Summary total—62 Synods	....	9,788	15,266	2,448,412

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LUTHERANISM. The first of the 95 theses which Martin Luther affixed to the door of the castle-church of Wittenberg on 31 Oct. 1517, read as follows: «Our Lord and Master, Jesus Christ, saying, Repent ye, would have the whole life of believers to be repentance.» This academic act has been generally looked upon as the inaugural act of the Lutheran Reformation, so much so, that 31 October is to this day celebrated by Lutherans in all lands as the Festival of the Reformation. And the thesis quoted above is perhaps the most concise exhibition of Lutheranism extant. The thesis is, as a whole and in all its parts, a positive doctrinal statement. Doctrine, positive doctrine, is, and was from the beginning, of first importance, the groundwork, the very life, of Lutheranism. The first and foremost task of the Lutheran Church is the promulgation and maintenance of sound doctrine. Preaching, in the Lutheran Church, is not primarily exhortation but teaching, and doctrinal preaching is considered the chief element of Lutheran public worship. Even the better part of Lutheran hymnology is preponderatingly doctrinal. The great bulk of Luther's voluminous writings is doctrinal, and no other church has so extensive a doctrinal literature as the Lutheran Church. Even its controversial theology partakes of this character. It is true, the Lutheran Church in all its best periods was eminently an *ecclesia militans* (a militant church); but the subjects at issue were again doctrinal. Perhaps the most masterful polemical work in Lutheran, if not in all Protestant theology, Chemnitz' 'Criticism of the Decrees of the Council of Trent' (*Examen Concilii Tridentini*), is also one of the richest storehouses of doctrinal theology.

But doctrine is knowledge communicated. Teaching presupposes or implies a master and a disciple or a number of disciples. And of the Master Luther says in his thesis: «Our Lord and Master Jesus Christ.» No councils nor synods, no traditions of the Church, no Fathers, early or late, not Luther himself, not any of these, nor all of these together, must be acknowledged as empowered to establish articles of doctrine which every disciple is bound to accept. For the *Master* is also the LORD. He comes with authority: His teaching is not human but divine. Christian doctrine is not a product of evolution, nor of human speculation, nor of self-consciousness of the Church, but the truth of God set forth by the Fountain of divine truth, who has said, «I am the Truth.» He is the one and only authoritative teacher in the Church. There is no such thing as an evolution or perfectibility of Christian doctrine. Here the ancient αὐτος ἔφη «He hath said it,» is in its place. Here man has no alternative but either to accept or to reject. Here to add or to modify is to adulterate, and to take away or to yield is to deny. Such is the Lutheran concept of the primary source of Christian doctrine.

But the means also whereby such communication of divine knowledge to man is effected is indicated in Luther's thesis when he says: «Our Lord and Master Jesus Christ, saying, Repent ye.» Here he refers to an express dictum of Holy Scripture. Christ and the Spirit of Christ taught man in the 16th century and teaches man in the 20th century in and through the written Word. Not by awaiting direct revelations, not by following the traditions of the Church or the definitions or decrees of its representatives, are we disciples of Christ, but by searching the Scriptures which were written aforetime for our learning. What is clearly taught in Scripture, that and that only is Christian doctrine. That the Bible is the only and sufficient source of Christian doctrine is the formal principle of Lutheranism.

The material principle of Lutheranism, the cardinal doctrine, around which all other doctrines radiate, because it is the central doctrine of Scripture, is also indicated in the thesis. Luther there describes the subjects and disciples of their Lord and Master Christ as believers. According to the Lutheran concept of Christianity and the Christian Church it is faith that constitutes a Christian and a member of the Church of Christ, which is simply the whole number of all believers. Christianity, as distinguished from all other religions, is that religion according to which salvation is not by works of righteousness which we have done, but by what God has done in Christ, reconciling the world unto Himself. And faith is simply the acceptance of this reconciliation. Not as a work of obedience, with any merit of its own, but only as the acceptance of the merits of Christ, faith is saving faith. It is justifying faith inasmuch as, in view and consideration of the merits of Christ accepted by faith, God in His judgment pronounces the believer righteous. And this doctrine, that God justifies the sinner by His grace, for Christ's sake, through faith, is the material principle of Lutheranism, the cardinal doctrine of Lutheran theology. This doctrine is looked upon by the Lutheran Church as *doctrina stantis et cadentis ecclesiæ,* the doctrine with which the Church stands and falls.

On the other hand, the doctrine of justification, while the central and ruling doctrine, is not the only doctrine of Lutheranism. According to our thesis, Christ would have the whole life of believers to be repentance. This, too, is a doctrinal statement. Repentance, *μετάνοια*, is a change of heart and mind in man. In his natural fallen state man is wholly evil, spiritually dead in sin, unable to will or to do that which is spiritually good. He cannot, therefore, work his own restoration, nor contribute thereto. But God, prompted by His universal grace, and because of the merits of Christ, the redeemer of all mankind, through the gospel, the ever efficacious and ever irresistible means of grace, quickens the sinner into spiritual life, translating him, by the bestowal of faith, from a state of wrath and enmity against God into a state of grace and communion with God. This is the Lutheran doctrine of conversion or regeneration in the stricter sense of the terms. In a wider sense, in which repentance also stands in our thesis, it includes the preservation and growth of spiritual life and its activity in works of the spirit, or sanctification. For while the Lutheran Church maintains that man's salvation is in no sense, manner or measure, his own work, but wholly and solely the work of God, and hence denies the necessity of good works unto salvation, it strenuously asserts that good works are necessary fruits and evidence of faith.

There have been Syncretists (Unionists) within the pale of the Lutheran Church, who held that the real obstacles to mutual recognition between the Lutheran Church and others were only two — the doctrines of predestination and of the Lord's Supper. But by these assertions Syncretism exhibits itself as thoroughly un-Lutheran in letter and spirit. These differences are indeed, while they stand, insurmountable barriers between the conflicting theologies. But the chasm which separates them is far deeper and wider, a difference of the very fundamental principles which affects a multitude of particular doctrines. The formal principle of Lutheranism is, as we have seen, that of the exclusive authority and absolute sufficiency of the canonical Scriptures in matters of faith. The material principle of Lutheranism is the scriptural doctrine of justification. Lutheranism holds that Christ, the only head and foundation of the Church, vested all the rights and powers of the Church, the keys of heaven, the power of remitting and retaining sins in His name as His agent, the government and discipline of the Church, in the local congregation of believers. Lutheranism maintains that Christ, the only mediator between God and man, has instituted an office in the Church, the ministry of the word, for the public administration of the means of grace, that this office is conferred on its incumbent by Christ's authority through the call of the congregation, and has no power but the power of the word as set forth in the Scriptures, all ministers being equal in rank among themselves. Lutheranism looks upon the Lord's Supper as a means of grace, whereby Christ, by virtue of His words of institution pronounced in the night in which He was betrayed, gives to all communicants His body and blood, really present, not by transubstantiation or the change into another substance, nor by consubstantiation or the formation of a new substance, but by sacramental union, to be eaten and drunk in, with and under the consecrated bread and wine, for an assurance of the forgiveness of our sins, procured by His sacrifice on Calvary.

Lutheranism also holds and teaches a doctrine of predestination, not, however, a decree of damnation, but only an election and predestination of the children of God to eternal salvation by faith in Christ Jesus, who is the redeemer not only of the elect, but of all mankind, and by whom the decree of election is determined as by its meritorious cause, and not as an accessory means of execution. Thus, likewise, the gospel and the sacraments, according to the Lutheran concept, are the ordained means, whereby the same universal grace, according to which God earnestly desires the salvation of all men, and, by the power of His Spirit in all cases efficaciously, but in no case irresistibly, exerted through such means of grace, calls, converts or regenerates, sanctifies and preserves to eternal life all those who do not wilfully and obstinately resist the saving grace of God.

Having thus briefly portrayed the nature and principles of Lutheranism, we proceed to a summary sketch of its rise and progress and its spread in the era of the Reformation.

The cradle of Lutheranism was Saxony in Germany. Here, at Wittenberg, the great Reformer taught and preached and wrote under the protection of the Elector Frederick the Wise, and hand in hand with his successors John and John Frederick. The effects of his 95 theses far exceeded the expectations of their author. When Luther published this manifesto, he had no thought of the establishment of a new church. The very name of Lutherans was not adopted by the free choice of those who bore it, but was solemnly inflicted upon them in a bull published by Pope Leo X 3 Jan. 1521. By this bull Luther and his adherents were excommunicated from the Roman Catholic Church, and when Luther had refused to recant at the Diet at Worms, April 1521, he and the Lutherans were also politically outlawed by an imperial edict, which exposed them to persecution and the death of confirmed heretics. The execution of this edict was suspended in Germany because of the great headway which the Lutheran movement had by this time made, and for various political reasons, which bound the emperor's hands, and at the Diet at Spires, in 1526, the German princes and representatives formally agreed that everyone should so conduct himself toward the Edict of Worms as he would deem himself able to answer before God and His Imperial Majesty.

Luther, who had for a time been concealed by the Elector in Wartburg castle, had made good use of his enforced rest by translating the New Testament into German and issuing the first instalments of his Church Postil, a collection of sermons, from which hundreds of ministers learned how to preach to the people. After his return and during the subsequent years the Lutheran Church in Saxony was organized along conservative lines. Luther provided the congregations with forms of worship and collections of hymns for public service, catechisms for the instruction of young and old and an extensive religious literature. A system of schools of various grades was established throughout the land and an able ministry was educated at the university. The translation of the whole Bible was completed in the course of years. At a second Diet of Spires, in 1529, a majority made an effort to stay the progress of Lutheranism in Germany, and in spite of the protest of the Lutheran members, from which they were called Protestants, these efforts were continued at the Diet at Augsburg, in 1530. Here, however, the Lutheran princes and cities succeeded in presenting to the emperor and Diet and thus publishing to the world a statement of their faith and doctrine, the Augsburg Confession, which, in the course of time, was adopted as its fundamental creed by the Lutheran Church the world over. In the same year an apology of the Augsburg Confession was framed and published, which also gained symbolical standing. Although the transactions of the Diet of Augsburg resulted in another proscription of Lutheranism and the inauguration of measures for its extermination, the political conditions of the empire continued to be such that the emperor and his party could not venture to proceed against the dissenters, and while Luther lived the progress and spread of Lutheranism continued, not only in Germany, but throughout Europe. Even when, after Luther's death, Charles V marched his armies against his Lutheran subjects and by fraud and force led away into captivity the two foremost of the German Lutheran princes and began the work of stamping out Lutheranism, these reverses, though causing considerable disturbance also within the Lutheran Church, lasted a few years only. The political conditions having once more turned in favor of the suppressed party, the Lutherans, in 1552, by the Treaty of Passau, secured temporary recognition as a church of lawful standing in Germany. This recognition was made permanent by the Peace of Augsburg in 1555. This settlement included the Lutherans only of all those who dissented from the Roman Catholic Church, Zwinglians, Calvinists, Anabaptists and others being excluded. It was thus menacing the religious as well as the political status of Lutheranism, when men of influence in Saxony, the Cryptocalvinists, by clandestine operations endeavored to change the Lutheran Church of Saxony into a Calvinistic establishment. At the same time a number of doctrinal controversies threatened to vitiate the orthodox character of the Church of the Augsburg Confession, until, by the united labors of Lutheran theologians and princes, sound in doctrine and deeply concerned about the peace of the Church and the purity of its doctrine, the last of the great Lutheran Confessions, the Formula of Concord, closed the series of Lutheran standards, all of which, the Augsburg Confession, its Apology, the Smalcald Articles, Luther's Larger Catechism, Luther's Smaller Catechism, the Formula of Concord, together with the three ancient Ecumenical Creeds of all Christendom, constitute the body of Lutheran Symbols, known as the Book of Concord of 1580.

While Germany was the home of the Lutheran Church, Lutheranism obtained a permanent foothold and became the church of the realm in a number of extra-German countries during the period of the Reformation.

In Sweden Luther's doctrine was disseminated as early as 1519 by two brothers, Lars and Olav Petersen, who had studied at Wittenberg. Under Gustavus Vasa, Lars Petersen was made professor of theology at the University of Upsala, and Olav Petersen was the leading preacher at Stockholm. The Bible was translated into Swedish and at the Diets of Westeras, 1527, at Orebro, 1529, and at Westeras, 1544, the organization of the Swedish Lutheran Church as a national church with an episcopal form of government was effected.

The first Lutheran preachers in Denmark were Peter Lille and Hans Tausen. The organizer of the Danish Lutheran Church was John Bugenhagen, pastor of Wittenberg, who came to Denmark in 1537 and prepared the new constitution, which was adopted at Odense in 1539. Soon after Norway and Iceland were also Lutheranized, and thus the Lutheran Church was permanently established without bloodshed throughout all the Scandinavian countries.

In Prussia the Lutheran Church was planted and made the church of this ancient territory of the German knights under John George of Polenz, bishop of Samland. The new Agenda and Church-Order was introduced in 1525 and 1526, and the new Lutheran University of Königsberg was a colony of Wittenberg, of which Sabinus, Melanchthon's son-in-law, was the first rector.

In Silesia Luther's doctrine was preached as early as 1518. John Hess was called as a Lutheran minister by the city council of Breslau.

In Poland Luther's writings were prohibited. But in 1521 the Bible was translated into Polish. Jacob Knade preached at Danzig. From Danzig Lutheranism spread to Elbing and Thorn, and by 1548 the Polish Church was preponderatingly Lutheran.

In the Baltic territories, Riga, Dorpat and Reval were Lutheran in 1523, and within two decades the Reformation spread throughout these whole regions.

In Hungary the doctrines of the Reformation were promulgated by men who had been Luther's students at Wittenberg. In 1549 five free cities adopted the Augsburg Confession, and under the influence of the Reformation numerous elementary and advanced schools were opened in cities and villages throughout all Hungary. Merchants who returned home from the fair at Leipzig brought Luther's doctrine to Transylvania, and others, who had been students at Wittenberg, promoted its spread. A Lutheran school was opened at Hermannstadt. From 1533 John Honter labored as «Evangelist of the Lord at Kronstadt,» and the Reformation took its course from town to town. In cities and villages and in the open country schools were established, and even in the village schools Latin and Greek were taught. With the schools libraries for the people were connected, and endowments were provided for the support of young men who were willing to study at German universities.

In Bohemia and Moravia a large part of the population embraced the Lutheran faith during Luther's lifetime, and when, after the reformer's death, the emperor made war against the Lutherans in Germany, the Bohemian Lutherans refused to take up arms against their brethren in the faith.

In the Netherlands, also, the Church of the Reformation gained headway, principally through the reading of Luther's works. In Antwerp a great Lutheran movement took place, brought on by the preaching of Flacius and Cyriacus Spangenberg, in 1565 and 1566. But it was not long before Lutheran services were prohibited. The Dutch Reformed Church was organized in 1568 and 1571 and proclaimed the church of the realm in 1583. With the Spaniards in possession of Antwerp, in 1585, the Lutherans scattered and founded congregations in Frankfort, Hamburg, Amsterdam, Leyden and other cities. Even there they had no rest. In Amsterdam they were antagonized and Lutheran services were again prohibited. Still the Lutheran congregations continued to enjoy a rapid and steady growth; so much so that a scarcity of ministers began to make itself painfully felt. The Lutherans in Holland had made the great mistake of neglecting the establishing of schools and colleges for the education of ministers, and this eventually brought about their decadence; for the importation of preachers from foreign countries was accompanied by the introduction of unionistic, syncretistic doctrines and practices.

France is another country in which Luther's writings were widely circulated and had great influence in the Church. A Lutheran congregation was organized at Maux. Faber Stapulensis, Briçonnier, Jean and Pierre Leclerc were some of the most noted preachers. Lefèvre translated the Bible into French. A sound Lutheran movement promised a bright future for Lutheranism, but the influence of Geneva, the stronghold of the Reformed Church, was very strong in France, and through this influence the Lutheran movement in France was directed into other channels.

In England Luther's books were read as early as 1519, especially at the universities, where they were of vast influence. Great efforts were made to suppress these books, and they were proscribed very early, but this only had the effect that they were now read more than ever. Thomas Cranmer embraced the Lutheran faith, and, though in many ways inconsistent, he remained a Lutheran in doctrine until the year 1548, when he was won to Calvinism. He became a martyr in 1556. A collection of Lutheran hymns was published being translations of German hymns, most of them Luther's. In 1536 the Augsburg Confession was printed in an exquisite translation by Taverner. In Sarcerius' ‘Commonplaces,’ a Lutheran handbook of dogmatic theology was given the English people. Cranmer, in the same year, at the close of which he abandoned Lutheranism, wrote an extensive explanation of Luther's Smaller Catechism, in which the first English translation of this catechism, also by Cranmer's hand, was embodied. The death of Henry VIII, whose political ambition had been to make himself the head of the Lutheran League of the continent, the personal acquaintance of many English and Scotch refugees with Calvin at Geneva and the imposing work there being reared, and other reasons contributed to the ascendency of Calvinism in England and Scotland, and the Lutheran movement became virtually extinct about the middle of the century.

For Lutheranism in America see Lutheran Church in America.

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LUTHER'S HYMN, a name given to the celebrated German hymn composed by Luther about 1521, entitled ‘Ein' feste Burg ist unser Gott,’ well known in the English version, ‘A mighty fortress is our God.’

LÜTKE, lüt'kĕ, **Feodor Petrovitch**, Count, Russian world circumnavigator: b. Saint Petersburg, 29 Sept. 1797; d. there, 30 Aug. 1882. He entered (1813) the English service, taking part in the siege of Danzig and made the first journey round the world (1817–18) under Golovnin. He explored (1821–25) the Arctic for a passage, was raised (1823) to lieutenant-captain and commanded (1826–28) the fourth voyage round the world, exploring the coasts of Russia and America and discovered several islands. In 1842 he was raised to the rank of adjutant-general and, in 1845, to vice-admiral. In 1864 he became president of the Saint Petersburg Academy of Sciences and was raised to the nobility in 1866. He wrote several works in the Russian language, chief of which is ‘Four Voyages into the Arctic Seas’ (Saint Petersburg 1829) and ‘Journey Round the World in the corvette *Senjarvin*’ (ib. 1835–36). His biography in Russian was written by Besobrasov (1889).

LUTON, loo'tŏn, England, town in Bedfordshire, 30 miles northwest by north of London by rail, situated on the river Lea. It has an old Gothic church (Saint Mary's), containing highly interesting brasses and monuments and an Early English font. Here are also a fine town-hall in Italian style, corn exchange and municipal park. It is the chief centre of Englands' great straw-plait industry, which originated when James I planted a Lorraine colony of straw-plaiters here. There are also brass and iron foundries and motor car works. The population in 1911 was 49,978. Consult Davis, 'History of Luton' (Luton 1855).

LÜTTRINGHAUSEN, lüt'rĭng-hou'zĕn, Germany, town in the government district Düsseldorf, on the Barmen-Rittershausen-Marienheide State Railway and five miles from Elberfeld. It is really a group of settlements numbering no less than 110, having municipal rights since 1856. There are large gas and water meter, gas oven, bathing apparatus, boiler, hardware factories, etc. Its population in 1910 was 13,560, mostly Evangelical.

LUTZ, loots', **Frank Eugene,** American biologist: b. Bloomsburg, Pa., 15 Sept. 1879. He was graduated (1900) at Haverford College, Pennsylvania, studied (1902) at University of Chicago, then entered University College, London, England. He was (1904–09) resident-investigator at the station for experimental evolution, Cold Spring Harbor, then (1909–16) assistant curator of invertebrate zoology at American Museum of Natural History, New York City, to become associate curator in the latter year. He has written 'Field Book of Insects' (1917) and numerous contributions to the scientific journals on the subjects variation, heredity, assortive mating, entomology, etc.

LÜTZEN, lüt'sĕn, Germany, small town of Prussian Saxony, nine miles southwest of Leipzig. It derives all its interest from the two battles fought in its neighborhood. The first belongs to the Thirty Years' War, being fought on 16 Nov. 1632, between the Swedes under Gustavus Adolphus, and the Imperialists under Wallenstein. The Swedish monarch, having joined his forces with those of Bernard, Duke of Saxe-Weimar, attacked the enemy in a strongly intrenched position. The issue was long doubtful, but the Swedes finally triumphed, though Gustavus fell in the action. The place of his death is marked by a square block of granite, called the Schwedenstein (the Swedes' stone). The second battle was fought 2 May 1813, somewhat farther south, at Gross-Görschen. It was the first important conflict between the allied Russian and Prussian armies and the French under Napoleon in that decisive campaign. The French numbered 115,000, while the allies had only 70,000. Napoleon maintained his position though at a loss of 18,000 men, against 10,000 of the allies killed and wounded. Napoleon being unable to press his advantage owing to lack of cavalry, the allies retreated in good order. Pop. about 4,086.

LUTZK, lütsk, Polish **LUCK,** Russia, town in the government Volhynia, on the river Styr and a branch of the South-West Railway. It has a 16th century castle, three Greco-Catholic and two Roman Catholic churches, two convents, two synagogues, Catholic seminary, etc. This is the centre of a great German colony. In the 11th century it was the capital of an independent principality but fell (1791) into the possession of Germany. Its population is about 31,806.

LÜTZOW, lüt'sō, **Franz Heinrich Valentin,** Count, Austrian author. He was born at Hamburg, educated at Vienna and Innsbruck and followed a diplomatic career. He was appointed chamberlain of the emperor of Austria from 1881. He was Ilchester lecturer at Oxford (1904), and in 1912 lectured at American universities. He has published 'History of Bohemian Literature' (1899); 'Prague,' in 'Mediæval Town' series (1901); 'Historians of Bohemia' (1905); 'Life and Times of Master John Hus' (1909); and 'The Hussite Wars' (1914).

LÜTZOW, Karl von, German historian of art: b. Göttingen, 25 Dec. 1832; d. 1897. He assisted Lübke (q.v.) in editing 'Denkmäler der Kunst,' and in 1867 became professor of the Polytechnicum, Munich. He published 'Munich Antiques' (7 vols., 1861–69); 'Masterpieces of Ecclesiastical Architecture' (1862); 'Monuments of Art,' with Lübke (6th ed., 1892); 'History of German Copperplate and Wood Engraving' (1891). He was the founder, in 1866, of the 'Zeitschrift für bildende Kunst,' and edited it till his death.

LÜTZOW, Ludwig Adolf Wilhelm, Baron of, Prussian general: b. Berlin, 18 May 1782; d. Berlin, 6 Dec. 1834. He is renowned as the leader of the noted Freischar (volunteer cavalry). He entered the ranks (1795) of the Prussian Guards, fought in the Reizenstein regiment (1806) at Auerstadt, and joined the Schill corps at Kolberg when his regiment was disbanded. He organized the cavalry, fighting and being wounded at Stargard and, receiving (1808) his discharge with the rank of major, he rejoined Schill, to be again wounded at Dadendorf. He re-entered (1811) the cavalry and was empowered (1813) to organize a corps of volunteers in Silesia and Jahn, Friesen, Körner, etc., joined him. The Lützow Volunteers were generally called the «Black Troopers» after their uniform, and were engaged in attacking flanks or in guerilla fighting and in Thüringen, Hessen and Westphalia raising insurrections. The plan proved a failure on account of apathy of the inhabitants and the raids on the rear of the French were followed by the battle of Grossgörschen. On the 17th June in spite of the armistice of Poischwitz being in operation Generals Fournier and von Normann (the latter a Wurtemberger) ambuscaded him near Leipzig and nearly wiped out the small body of troopers. They reorganized and added to their fame as intrepid raiders in the engagement at Göhrde (16 Sept. 1813) when they helped beat the French division, he again being severely wounded. He next is found with his troopers fighting the Danes. In March 1814, he was taken prisoner by the French militia while carrying dispatches from the Silesian army corps under Blücher at Chalons. Gaining his freedom when peace was made he was advanced to lieutenant-colonel and (1814) was given command of the 6th Uhlan regiment, to be taken prisoner in the battle of Ligny, to be again freed by the peace gained through the victory of Belle-Alliance. He was raised to a colonelcy in 1815, to major-general in 1822, retiring in 1830 as a lieutenant-general. Theodore Körner the poet, one of his volunteers, has made the Black Troopers eternally noted by his gripping poem 'Lützows wilde Jaged.' Consult Ciselen, 'Geschichte des Lützowschen Freikorps' (2d ed., Halle 1841).

LUVERNE, lū-vėrn', Minn., village, county-seat of Rock County, on the Rock River, and on the Chicago, Saint Paul, Minneapolis and Omaha and the Chicago, Rock Island and Pacific railroads, about 220 miles southwest of Saint Paul and 30 miles northeast of Sioux Falls, S. Dak. Luverne is situated in an agricultural region in which are granite quarries and fire-clay deposits. The chief industrial establishments are flour-mills, grain elevators, brick and lumber yards, automobile factories, tile works, concrete-block plant and creameries. Large nurseries are in the vicinity. The trade is principally in flour, granite, grain, live-stock, nursery products and dairy products. The waterworks and electric-light plants are the property of the city. Pop. about 2,540.

LUXEMBOURG, François Henri de Montmorency-Bouteville, frän-swä ŏn-rē dė môn-mŏ-rŏn-sē boo-tē-vēl lûk-sŏn-boor, DUKE OF, marshal of France: b. Paris, 8 Jan. 1628; d. Versailles, 4 Jan. 1695. He served when young under the Prince of Condé; in 1662 was made a duke and peer of France, and in 1667 lieutenant-general. In 1672 he commanded during the invasion of Holland; in 1673 made a masterly retreat from Utricht to Maestricht, although outnumbered by three to one; and having gained the battle of Senef in 1674, was created a marshal of France (1675). Louvois attempted to compass his ruin by involving him in 'The Affair of the Poisons'; he was imprisoned in the Bastile, but acquitted; and in the war of France against England, Holland, Spain and Germany he won the three great battles of Fleurus (1690), Steenkirk (1692) and Neerwinden (1693). Consult Segur, R. de, 'La Jeunesse de Maréchal de Luxembourg' (Paris 1900); 'Le Maréchal de Luxembourg et le prince d'Orange 1668–78' (ib. 1902).

LUXEMBOURG (lŭk'sĕm-bėrg, Fr. lük-sŏn-boor) **PALACE**, a structure famous for its architecture, art gallery and gardens; situated in Paris, in the Rue de Vaugirard. It was begun in 1616 and completed in 1620. The art gallery was opened in 1780 and closed during the Terror, was altered in 1790 and was much enlarged in 1830. Here Ney was condemned to death after the Restoration in 1815. At this latter date a magnificent semi-circular hall was built for the session of the House of Peers, and later for the Senate. The Senate hall was burned in 1859, but was soon after rebuilt. The name of the palace is derived from the Duke of Piney-Luxembourg, whose mansion once stood on the same site. From 1870 to 1879 the palace was occupied by the Prefecture of the Seine and the Paris municipal council. Since 1879 it has been again occupied by the Senate.

LUXEMBURG, Rosa, German Socialist agitator: d. Berlin, 15 Jan. 1919. A Russian-Polish Jewess of obscure origin, she was between 50 and 60 years of age. According to some accounts she married a German in order to obtain German nationality, and left him immediately. A remarkably eloquent speaker, she always expounded the most extreme views, which gained her the nickname of "Red Rosa." She was a cripple, barely five feet high. In 1906 she was already working in alliance with Liebknecht (q.v.), arguing the doctrine of the general strike against Bebel (q.v.) at the Jena Congress of the German Socialist party, which occasion led to her first imprisonment for incitement to violence. She invariably advocated direct action for the seizure of power, a principle analogous to that exemplified by the Russian Bolsheviki. Early in 1914 she made accusations of brutality against German army officers, for which she was sentenced to imprisonment. Released in 1916, she was soon put under preventive arrest and severely treated. During the revolution that followed the German military collapse in November 1918 Rosa Luxemburg was the fiercest firebrand of the Spartacide group. Conflicting reports stated that she was shot while being removed under arrest, or was felled by the butt-end of a rifle and thrown into the canal during a riot in Berlin. Liebknecht was killed about the same hour.

LUXEMBURG, William Alexander, GRAND DUKE OF: b. April 1852; d. 25 Feb. 1912. His branch of the family (Walram) succeeded to the dukedom on the extinction of the male line of the Otho branch on the death of the king of Holland in 1890. He became incapacitated by cancer in 1908, when his consort — a Portuguese princess — was appointed to act as regent. He left six daughters, the eldest of whom, Marie, came of age (18) in 1911 and assumed the sovereignty of the grand duchy.

LUXEMBURG (Fr. lük-sŏn-boor, Ger. look'sem-boorg), **Grand-duchy of**, northwestern Europe, an independent state, bounded north, east and south by Germany, southwest by France and west by Belgium; greatest length, north to south, 55 miles; greatest breadth, 34 miles; area, 998 square miles. It forms part of the plateau of the Ardennes, and has a rugged and mountainous surface, covered in many parts with heaths and morasses, though in general well wooded. Its drainage belongs almost entirely to the basin of the Moselle. Agriculture is limited in extent by the nature of the surface, but the pastures rear great numbers of cattle, sheep and horses, the last long in high repute for light cavalry. Considerable quantities of iron are smelted from the ore of the duchy. The inhabitants are mostly of German origin, but French is the language of the educated classes and of business. Pop. about 259,891 (4,007 Protestants, 1,270 Jews).

Luxemburg in early times formed a part of Germany. In 1354 it was erected into a duchy by Charles IV. In 1814 it was converted into a grand-duchy under the king of Holland. Though governed by the Dutch kings as grand-dukes it was distinct from the kingdom of Holland; and on the death of Wilhelm III in 1890 it passed over to Adolf, Duke of Nassau. It is included in the German Customs Union and formerly was a member of the German Confederation, 1815–66. By the terms of the Treaty of London of 1867 it became an independent state, and its integrity was guaranteed by the great European powers. The ruler is assisted in the government by a chamber of deputies of 53 members, elected directly by the cantons for six years, half of whom retire and submit themselves for re-election every three years. The revenue for 1917–18 was estimated at 43,761,428 francs, and the expenditure 48,845,794 francs. There are 325 miles of railway in the grand-duchy, and 439 of telegraphs. On the outbreak of the Great War in August 1914, its neutrality was violated by Germany, despite the protests of the reigning grand-duchess, Marie Adelaide, who had succeeded 12 Feb. 1912, on the death of her father, the Grand Duke Wilhelm. The territory was occupied by the German army. Under the terms of the Peace Treaty of 7 May 1919 (Section III) it was stipulated that Germany renounce her various treaties and conventions with the Grand Duchy and recognize that it ceased to be a part of the German Zollverein as from 1 Jan. 1919; to renounce all right of exploitation of the railroads; to adhere to the abrogation of its neutrality and to accept in advance any international agreement concerning Luxemburg arrived at by the Allied Powers. (See WAR, EUROPEAN). Capital, Luxemburg (q.v.). Consult Passmore, T. H, 'In further Ardenne' (London 1905); and Renwick, G., 'The Grand Duchy of Luxemburg and Its People' (ib. 1913); Putnam, Ruth, 'Luxemburg and Her Neighbors' (New York 1919).

LUXEMBURG, the capital of the grand-duchy of the same name, situated 117 miles southeast of Brussels and 42 miles by rail north of Metz. Its natural position is so strong, and the different powers into whose hands it successively fell did so much to extend and improve its means of defense, that it was called "the northern Gibraltar." From 1839 till 1866 it was garrisoned for the Germanic Confederation by Prussian troops, but in accordance with the Treaty of London (1867) the fortifications were dismantled, the Prussians withdrew their troops and the neutrality of the duchy was guaranteed by the great European powers. During the Great War which began in 1914 it was in German occupation. It is divided into a low and a high town. The former lies along the banks of the Alsette. The latter stands 200 feet higher, on a plateau with precipices on three sides, the surrounding ravine being crossed by great viaducts. The town is well built; contains a town-house, government-house, house of deputies, cathedral of Notre Dame dating from 1613, Athenæum, Roman Catholic seminary for priests, grand-ducal palace dating from 1580 but rebuilt 1893–94, library, a handsome public park, etc. It has manufactures of machinery, leather gloves, breweries, dye-works, etc.; and a considerable trade. Luxemburg is the see of a bishop; and during part of the year is the residence of the leading families of the duchy. Its neighborhood abounds with fine promenades and picturesque features of various kinds. Pop. 20,848.

LUXOR, lŭk'sôr or look'sôr, Upper Egypt, a village on the right bank of the Nile, occupying the site of ancient Thebes and containing splendid ruins of that historic metropolis. See THEBES.

LUZAC, Jean, Dutch editor and champion of American independence: b. Leyden, 2 Aug. 1746; d. 12 Jan. 1807. Editor of the *Leyden Gazette* which, from 1722 to 1783, published in Dutch and French, circulated all over Europe as a standard authority, giving authentic and correct news from the United States of the Continental Congress and armies. He served grandly the American cause, for which he was thanked by Washington, who sent him a souvenir of his campaigns. Of Walloon descent and well educated, he became one of the ablest news gatherers and newspaper men in Europe. After 1785, he was professor of Greek in Leyden University, and in 1794–95 was Rector Magnificus. He was active during his life as a publicist and among his many writings in Dutch and Latin was a eulogy on Washington. His tomb is in Saint Peter's Church, Leyden, and there are portraits of him. On 8 Sept. 1909 a tablet was placed by grateful Americans on his former dwelling, at No. 112 Rapenburg, Leyden, which was unveiled by one of his descendants, to the singing of "The Star Spangled Banner." Consult address by Gulian G. Verplanck, 1818, before the New York Historical Society; Griffis, 'Brave Little Holland' (1894); 'Nieuw Nederland Biografisch Woordenboek' (Vol. I, 1911).

LUZÁN, loo-thän, Ignacio de, Spanish writer: b. Zuragoza, 1702; d. Madrid, 19 May 1754. He was son of Antonio de Luzán, Lord of Castillazuelo and governor of Aragón, while his mother belonged to the family of the counts of Villar. He was graduated with the degree of doctor of theology from the University of Catana (Sicily) in 1727 with an excellent knowledge of ancient and modern languages, mathematics, philosophy, literature, history and theology. In 1747 he was appointed secretary to the Spanish embassy at Paris. On his return to Spain, two years later, he occupied several important public offices, among them head of the mint and treasurer of the Real Biblioteca. He became a great favorite with the king who liberally pensioned his widow. He was a voluminous writer and he left at the time of his premature death over 60 works, the most important of which are 'Chronologia para uso del estudio'; 'Compendio del las cuatro principales partes de la Filosofía'; 'Tratados de Dote,' etc.; 'Resumen de las Instituciones, con notas en auxilio de los textos del Código'; 'Relorica de las conversaciones'; 'Tratado de Ortografía española'; 'Método para euseñar y aprender las lenguas'; 'La Poética'; 'Discurso apologetico'; 'La Geganteina'; 'Perspectiva politica'; 'La virtud coronada' (comedy); 'Origen y Patria de los godos'; 'Doctrine politica sacada de proverbios y palabras de la Sagrada Escritura'; 'La razón Contra la moda' (comedy, translated work of Nivelle de la Chaussée); 'La Gatomiomaquia' (satire). His literary work also includes many and varied translations, among them being odes of Sapho, Anachreon, Metastasio, Ovid, Horace and Biblical poetry, especially the Psalms. He also composed poems in Latin and Italian. The range of his literary work was very wide, covering poetry, philosophy, politics, grammar and languages, criticism and translation. Spanish critics place him among the foremost writers of Spain; Spanish reviewers who have paid much attention to his work are inclined to rank his poems and his criticism as superior to his other productions. Of the latter his 'Poética' is his best. Luzán is distinguished by imagination, beauty of style and clearness of thought. All these qualities are present in the 'Poética,' which is a notable work for the age in which it was written. It has, therefore, had a powerful influence on the development of Spanish literature. Consult Ticknor, 'History of Spanish Literature'; White, Blanco, 'Life of Thom'; any good history of Spanish literature.

LUZENBERG, loo'zĕn'bĕrg, **Charles Aloysius,** American physician: b. Verona, Italy, 1805; d. 1848. He was educated at London and at Weissenburg College, Alsace. Leaving Italy for the United States in his 14th year, he subsequently received a medical education at the Jefferson Medical College of Philadelphia. He removed to New Orleans in 1829, where he made a reputation for brilliant surgery and was enabled to establish the famous New Orleans Medical School. He visited Paris in 1832, where his reputation had preceded him, and he was elected corresponding member of the Paris Academy. His most important work in Louisiana (where he took up his residence again in 1834) was the founding of the Society of Natural History (1839), and the Louisiana Medico-Chirurgical Society (1843), by which science has been much fostered and promoted in the South. It is believed that he was the first physician in the United States, who prevented pitting in cases of smallpox, by excluding light from the sick chamber.

LUZERNE, lū-zĕrn, N. Y., town, including a village of the same name, in Warren County, on the Hudson River, at the mouth of the Sacandaga River, about 20 miles north of Saratoga and 10 miles southwest of Lake George. Lake Luzerne is in the vicinity. The village is situated in an agricultural and lumbering region, and its chief industries are connected with the manufacture of paper, shirts, lumber and with farm products. A bridge crossing the Hudson connects Luzerne with Hadley, a station on a branch of the Delaware and Hudson Railroad. The cool climate in this region in summer, the beautiful scenery and the opportunities for fishing make it a favorite summer resort. Pop. 1,185.

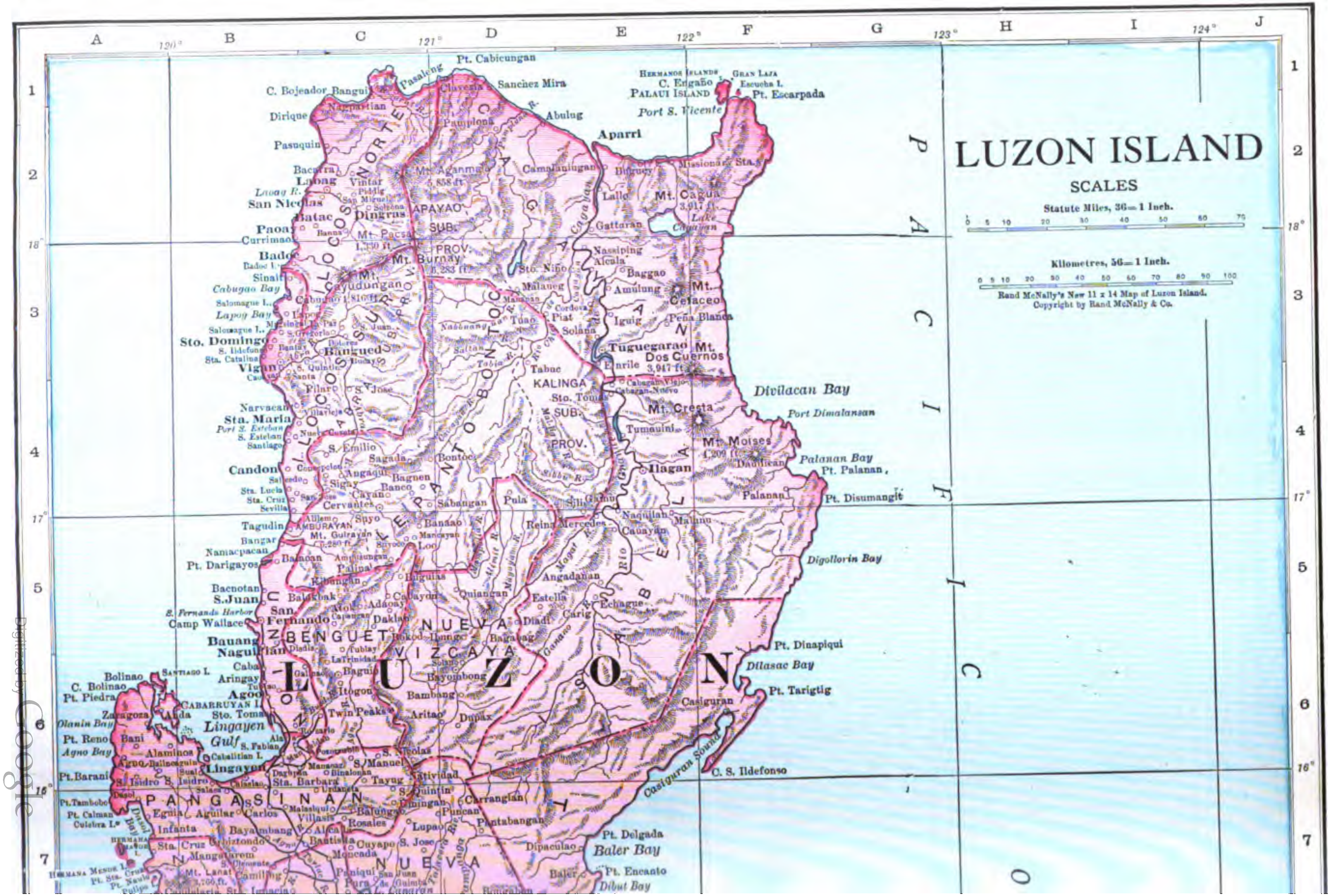
LUZERNE, Pa., post borough of a county of the same name eight miles by rail from Lackawanna Junction. It has two drill factories, four flour and feed mills, etc., besides coal mines. Pop. 5,500.

LUZÓN, loo-zōn' (Sp. loo-thōn'), Philippines, the largest, most populous and wealthy and with the exception of the Batánes and Babuyánes groups, the northernmost island of the Philippine Archipelago, lying south-southwest of Japan and south-southeast of China. It lies between lat. 12° 32′ and 18° 39′ N. and between long. 119° 42′ and 124° 8′ E. On the north is the Bashi Channel, connecting the Pacific Ocean and the China Sea; on the south are the San Bernardino Strait, separating it from Sámar, the channels of the Visayas Sea and Tayabas Bay.

Topography.— The island is very irregular in shape, elongated from north to south and southeast, and much wider at the north than at the south. It narrows at lat. 14° 30′, and much more at lat. 14° between Lamón Bay and Tayabas Bay, where an isthmus unites the larger and northwestern part of the island with the smaller southeastern part; it is thus divided into three territorial divisions, Northern Luzón, Central Luzón and Southern Luzón. The length of Luzón is 283 miles from the north coast to Manila, and from there 225 miles southeast to Babulgum Point; at its widest point near the centre of Northern Luzón it is 138 miles wide; at its narrowest point, the isthmus in lat. 14°, eight miles wide; area, 40,969 square miles, with dependent islands, 42,196 square miles. The mountain system of Luzón consists of three large ranges, the nucleus of which is Caraballo de Baler in the province of Neuva Ecija. The Caraballos Occidentales form the watershed of Northern Luzón, and extend about 150 miles near the western coast and parallel with it; the Sierra Madre range, starting at Caraballo de Baler, extends northeast to Cape Engaño; the Caraballos Sur, starting at the same point, extends south to Banahao, then turns to the southeast and terminates near the straits of San Bernardino. This range has several important branches, one ending on the south side of the bay of Baler. Among the more important single mountains the following may be mentioned: Datá (7,364 feet), and Burnay (6,376 feet), of the Caraballos Occidentales; Cana (3,830 feet) of Sierra Madre; and Bulusan and Mayón (7,916 feet) of the southern range. The three last mentioned are volcanoes, of which Mayón is the most active. Luzón is well watered; the longest river is the Rio Grande de Cagayán, running nearly the whole length of Northern Luzón; three other large rivers traverse this part of the island, and there are numerous smaller streams. The Pasig River, although the shortest of all, is from a human standpoint by far the most important of all. Its length is 15 miles, and it affords communication between the Laguna de Bay, the largest of the island's lakes, and Manila Bay. Its importance is mainly due to the great volume of commerce which travels along it and to the fact that the capital of the archipelago is situated at its mouth. This river is tidal in its lower section, and very deep up to Fort McKinley; from that point to the lake it is much narrower and quite shallow in places, and has a very treacherous current. The coastal plains about the island are, as a rule, very narrow, the maximum width being about 10 miles. The mountains are nearly everywhere close to the sea. The dominant features of Luzón, as of other portions of the archipelago, are the enormous coast line and the mountainous character of much of its interior.

Roads and Industries.— There are a number of fine roads in Luzón, which centre at Manila, connecting it with remote points. In 1917 there were 616 miles of railways in operation. All the staple crops of the archipelago grow in abundance, and the chief industries of the island are agriculture, and the development of the products into the advanced forms of manufacture; the mechanical industries are very largely confined to Manila. Luzón is also rich in forests, having all the woods used in building, as well as the gum-producing, medicinal and dye-trees.

Mineral and Agricultural Products.— Gold is found in Nueva Ecija; copper (in the form of arsenates and sulphides) in the Mancayan-Suyoc district of the Mountain province; iron occurs in a fairly well-defined belt which follows the east coast for a short distance,



LUZON ISLAND

Rand McNally's New 11 x 14 Map of Luzon Island.

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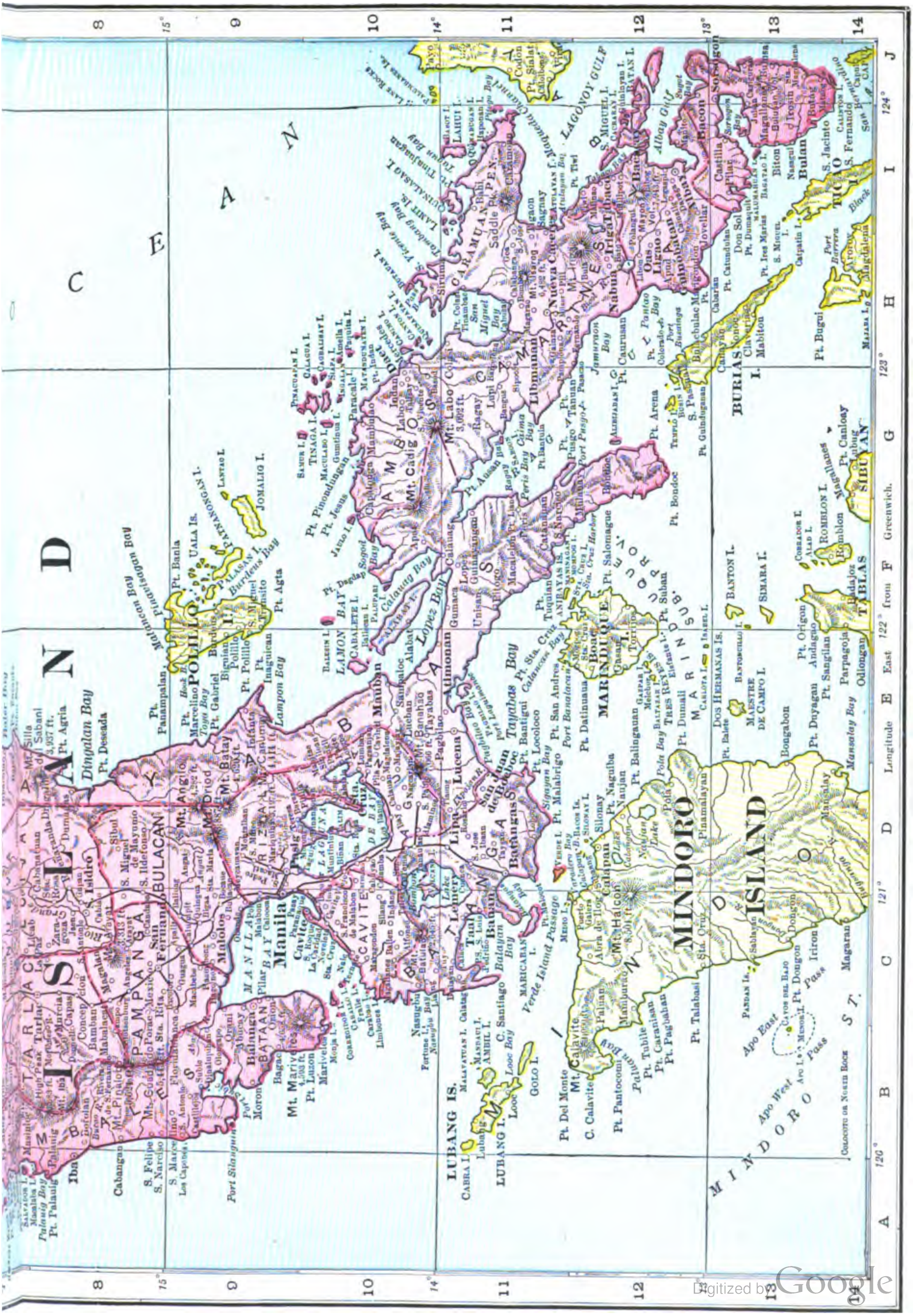
OCEAN
LUZON
MINDORO ISLAND
MARINDUQUE I.
BURIAS I.
POLILLO I.
LUBANG IS.
Manila
MANILA BAY
LAGUNA DE BAY
BATAAN
PAMPANGA
BULACAN
TARLAC
ZAMBALES
RIZAL
CAVITE
BATANGAS
TAYABAS
AMBOS CAMARINES
SORSOGON
ALBAY
SIBUYAN
TABLAS
Verde Island Passage
Tayabas Bay
Lamon Bay
Lopez Bay
Ragay Gulf
Lagonoy Gulf
Albay Gulf
Sibuyan Sea
Mindoro St.
Dingalan Bay
Mt. Halcon 8,501 ft.
Mt. Mariveles
Mt. Arayat
Mt. Banahao
Mayon Vol.
Ticao
Longitude East 122° from Greenwich
8
9
10
11
12
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14
A
B
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E
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15°
14°
13°
120°
121°
122°
123°
124°

beginning in the Camarines and then turning toward the interior, where it reaches, so far as our knowledge now goes, its greatest development near the town of Angat in Bulacan province. One of the principal localities in which coal is found is Batán Island, Albay province, where it is of a sub-bituminous variety, with volatile combustible, 39.98 per cent; fixed carbon, 48.80 per cent; ash, 5.70 per cent; moisture, 5.74 per cent and sulphur, 0.66 per cent. Salt springs occur in the Mountain province. Agricultural products are those of the burí and nipa palms (burí and tuba), cocoa, coffee, cotton, tobacco, hemp, pineapples, bananas, betel nuts, copra, mangoes, corn, rice, sugar, sweet potatoes, etc. The live-stock raised on this island is given as two-thirds of the total (including domestic animals and poultry) for the entire archipelago.

Salient Facts.— A writer in the *Journal of Geology* (Vol. XXI, pp. 29–61, Chicago 1913) observes that "because of its great strategic importance and because it is the home of the only Christianized people of Malay origin, Luzón is of more than passing interest. Geologically, it is worthy of constant study as it is a link in that great Circle of Fire which girds the Pacific. As a mining field, evidence is already abundant that Luzón will before many years have a place in the very first rank." He adds that its geographical position is also noteworthy, this being a region of tremendous rainfall (45 inches in 24 hours, Baguio Observatory record, July 1911) and in the track of the most frequent and violent typhoons; and that as it extends to lat. 21° N. and has much high level country, which is at the same time fertile, it should be colonized by white men. Historically interesting are the following facts: It was the first of the Philippine Islands to come under the control of the United States; it was the scene of the earliest military operations against the insurgents, and the base of operations for campaigns of occupation of the other islands. See articles on individual provinces and general article PHILIPPINE ISLANDS.

According to the official post route maps, showing post-offices, etc., in operation on 1 Oct. 1914, Apayao, Kalinga, Lepanto, Bontoc, Ifugao and Benguet are all included in Mountain province. The total number of Luzón's inhabitants (including about 220,000 uncivilized) is, in 1917, somewhat more than 3,800,000. Consult 'Census of the Philippine Islands, taken under the Direction of the Philippine Commission' (Washington 1905); *Philippine Journal of Science* (Vol. V, Manila 1910); Wilcox, M., 'Harper's History of the War in the Philippines' (New York 1900); Worcester, D. C., 'The Philippines Past and Present' (New York 1914).

Provinces and Population.— The provinces into which Luzón is divided are as follows:

Albay.
Apayao.
Ambos Camarines (Norte and Sur).
Bataán.
Batangas.
Benguet.
Bulacan.
Cagayan.
Cavite.
Ifugao.
Ilocos (Norte and Sur).
Isabela.
Kalinga.
Laguna.
La Unión.
Lepanto-Bontoc.
Nueva Ecija.
Nueva Vizcaya.
Pampanga.
Pangasinán.
Rizal.
Sorsogon.
Tárlac.
Tayabas.
Zambales.

LUZZATTI, loo-tsät'tē, **Luigi**, Italian statesman and financier: b. Venice, 1841. Of a wealthy Jewish family, he studied law in the Instituto Tecnico at Milan and was appointed (1867) professor of political economy at the Padua University. In 1870 he was elected a member of the Chamber of Deputies but the election was declared illegal because he had not yet become of the necessary legal age and he was not admitted till 1871, after a third election had been held. He quickly gained fame on questions of finance and was several times member of the Budget Committee. He was Minister of the Treasury (1891–92) in the Rudini-Nicotera Cabinet and filled that office also 1896–98, when he went to Perugia as professor. In 1903 he was given a portfolio for the third time as Minister of the Treasury under Giolitti, continuing in office under Sonnino (1906). In 1910 he became president of the ministry with portfolio of Minister of the Interior. He wrote 'Lo Stato e la Chiesa nel Belgio' (1866); 'Il socialismo e le questioni sociali dinanzi ai parlamenti d'Europa' (1883); 'Le classi dirigenti e gli operai in Ingkilterra' (1893); 'La liberté de conscienze et de science' (1910).

LUZZATTO, loo-tsät'tō, **Samuel David**, Jewish theologian and Hebraist: b. Triest, 22 Aug. 1800; d. Padua, 29 Sept. 1865. He greatly advanced the study of Jewish science independently through such work as translating the Hebrew prayers and biblical works such as the Pentateuch with the Hastarot, Isaiah, Job, etc., into the Italian, through commentaries, dissertations on the Hebrew and Chaldaic languages, Targum Onkelos, Kabbala, etc. He issued treasures in manuscript from his library and sent many monographs to the periodicals. Among the most prominent of his other works are 'Elementi grammaticali del caldeo biblico e del dialetto talmudico babilonese' (1865); 'Grammatica della lingua ebraica' (1853); 'Introduzione critica ed ermeneutica al Pentateuco' (1870).

LVOFF, l'vŏf, **Alexei Fedorowitch**, Russian violinist and composer: b. Reval, 6 June 1799; d. Kovno, 7 Jan. 1871. He obtained a thorough training on the violin early in life but continued his studies after entering the army. His zealous work brought him the rank of major-general and adjutant of the Emperor Nicholas as well as director of the choir at the court (1837–61), during the same time acting as inspector of musical education at the schools. Toward the last he lived a retired life on account of his loss of hearing. He composed (1833) the music for the Russian national anthem, 'God protect the Tsar' for the ceremony of unveiling the monument of Shukovski, who wrote the words. Among his operas are 'Undine' (1848), his only one that was a success; 'Bianca e Gualterio' (1845); 'Starosta' (1854). He wrote from his great knowledge of Russian Church songs 'Concerning the free and unsymmetrical rhythm of the true old-Russian songs.' Numerous violin compositions for concert, duet, quartette, etc., were written by this clever composer. Consult his autobiography (2d ed., Saint Petersburg 1896); Lvoff, E. N., 'Memoirs' (ib. 1880).

LYALL, lī'al, SIR **Alfred Comyn**, English author and civil servant: b. 1835; d. 10 April 1911. He was educated at Eton and Haileybury, entered the Bengal civil service and served with distinction in the volunteer cavalry during the Indian Mutiny. He was appointed home secretary to the Indian government in 1873, and foreign secretary in 1874, and was governor of the Northwest Provinces of India 1882–87. He was afterward a member of the Council of India, 1888–1903. He was the founder of the new university of Allahabad. He was created K.C.B. in 1881, and G.C.I.E. in 1896. He was the author of 'Verses Written in India' (1889); 'British Dominion in India' (1893); 'Asiatic Studies' (1882, 1899); 'Life of Warren Hastings' (1889); 'Tennyson' in the English Men of Letters series (1902); 'Life of Lord Dufferin' (2 vols., 1905); and 'Studies in Literature and History' (1915). His 'Life,' by H. M. Durand, was published in 1913.

LYALL, Edna. See BAYLY, ADA ELLEN.

LYALL, James, American inventor: b. Auchterarder, Scotland, 13 Sept. 1836; d. New York, 23 Aug. 1901. He was brought to this country as a child; when old enough worked at loommaking in his father's shop; was a soldier of the 12th New York Infantry during the early part of the Civil War; and afterward became a manufacturer of jute and cotton goods and of machines. He designed corset-making machinery and produced the first machine-made corsets ever manufactured. He also invented a waterproof varnish, and in the latter part of the war knapsacks and haversacks waterproofed by his process were largely used in the Union army. The Lyall positive-motion loom, for weaving wide fabrics, was invented by him in 1863. Various other inventions of his are much employed in cotton manufacture. He received many medals and decorations, including the gold medal of honor from the American Institute, bestowed on him in 1869.

LYCANTHROPY. See WERE-WOLF.

LYCAON, lī-kā'ŏn, a mythical king of Arcadia, generally represented as a son of Pelasgus by Melibœa, daughter of Oceanus, and described by some as the first civilizer of Arcadia, by others as a barbarian who defied the gods. He became by several wives the father of a great number of sons, so notorious for arrogance and impiety that Jupiter resolved to punish them. Appearing to them at their dwelling in Arcadia disguised as a poor man, they invited him to a repast, at which was served up the flesh of a boy whom they had murdered. The god, rejecting the food, transformed Lycaon and all his sons save one into wolves, or according to other accounts destroyed them by a flash of lightning. The flood of Deucalion was said by some to have been a consequence of the crimes of the Lycaonidæ.

LYCAONIA, lĭk-ạ-ō'nĭ-ạ, Asia Minor, the name of an ancient division which was bounded north, east, south, southwest and west by Galatia, Cappadocia, Cilicia, Isauria and Phrygia, and is now included in the Turkish province of Caramania. It is a somewhat bleak region; sheep and wild asses were bred here in ancient times. Lycaonia is first mentioned in Xenophon's history of the expedition of the younger Cyrus as belonging to the Persian Empire. After its conquest by Alexander and his death, it was attached to the kingdom of Syria, and subsequently came into the possession of Eumenes, king of Pergamus, while the other part was ruled by native chieftains. In the latter half of the 1st century B.C. it was conquered by Amyntas, king of Galatia, with which country it passed on his death to the Romans under Augustus, being annexed to the province of Cappadocia. The inhabitants, according to the Acts of the Apostles, spoke a peculiar dialect. They were warlike and skilled in archery. The principal town was Iconium, now Konieh, which stood close by the great highroad from Sardis and Ephesus to the Sicilian gates. Consult Ramsay, 'Historical Geography of Asia' (London 1890); and 'Cities of Saint Paul' (New York 1907).

LYCÉE (French for lyceum), the designation in France for state schools for secondary or intermediate education providing a three years' classical course preparatory to the higher and final courses of instruction given by universities, with their faculties of letters, law and medicine. The number of lycées for boys is 112, with an average attendance of 63,000, maintained at an annual expenditure of nearly 45,000,000 of francs; the number of lycées for girls is 52, maintained at an expenditure of about five and one-half millions of francs. Nearly 5,000,000 of francs are devoted annually to scholarships and prizes in lycées for boys and girls. There are also communal colleges for secondary education, comparable to the American high school. The course of studies in the lycée, however, is of a much more extended character than that of the communal college, the lycées of the larger towns preparing students for positions in the different administrative departments of the national government. The lycées originated under the first republic, and their courses of instruction, administration and discipline occupy an important position in the decree of 17 March 1808, on the reorganization of the university system. From 1815 to 1848, during the restoration of the monarchy, the lycées were called royal colleges (collèges royaux).

LYCEUM (Latin, from the Greek Lykeion the great gymnasium of ancient Athens), a school of higher education preparatory to the work of the university; and in a secondary sense, a public building or hall in which lectures of a scientific and informative nature are given. A later meaning of the word, which has, in the United States and Canada pretty nearly supplanted its more primitive significations, is that of an association for literary and educational improvement. The American Scientific Lyceum was the idea of Josiah Holbrook of Derby, Conn., who, in 1826, organized the «Millbury Branch No. 1 of the American Lyceum.» Holbrook was one of the first advocates in the United States of the necessity of teaching the natural sciences in American schools. Previous to 1826 he had spent some years lecturing from town to town throughout Massachusetts and Connecticut on geology and mineralogy and incidentally on others of the natural sciences; and he organized, in the various villages and towns where he lectured, societies for the purpose of collecting specimens and the extension of mutual aid on the part of the members in their study of science. His efforts, long persisted in, did much to introduce into the public schools of the United States the systematic and practical study of the natural sciences. Holbrook dreamed of seeing established in every town and village of the United States a branch of what is called "The American Lyceum," with library and natural history, minerological, geological and other specimens, catalogued, grouped and arranged in the best manner for study on the part of the members of the lyceum, who were expected to mutually aid one another. According to his plan there were to be country, town, State and national lyceums, the national lyceums being composed of delegates from the State lyceums, and the latter of delegates from the country and town institutions. Some 15 neighboring villages responded to Holbrook's call within a few months of the organization of the Millbury branch. By the end of 1827 these had increased to over 100; and a year later there were lyceums in nearly every State in the Union; and by 1834 some 3,000 lyceums had been established in towns throughout the United States. Some States, like Massachusetts, appointed State boards to promote lyceum work. The States ran races with one another in their efforts to organize State lyceum associations. New York was the first in this race, but was followed closely by Massachusetts and several other New England States. Florida, too, was up near the top of the list. In May 1831 a convention for the organization of an American Lyceum met in New York City representing, through its delegates, over 1,000 town lyceums. The new organization took its stand for "the advancement of education, especially in the common schools, and the general diffusion of knowledge." A national convention was held in 1839, constituting itself the American Lyceum Union; and its enthusiastic meeting, which was extensively reported in the press, had very considerable influence upon the improvement of the public school system of the United States. It and the State and town lyceums bequeathed to the American people educational, literary and other associations, lecture bureaus, scientific societies and a nation-wide interest in the study of science. From one end of the land to the other men prominent in educational, literary, ecclesiastical and political life took an active part in the lyceum movement, and the larger cities were as active and enthusiastic in the work as the towns and country villages. There was scarcely a New England town that did not have its lyceum organization. In this work Boston led the way, and its lyceum was presided over for several years by no less a personage than Daniel Webster. Down into the closing years of the 19th century the activity of the lyceum continued to hold aloft the banner of self-instruction through lectures, debates, classes for study and mutual help, essays, conversation and public readings and recitations. Weekly meetings were generally held and home talent, for the most part, supplied the program free of charge during the first 15 or more years of the life of the lyceum. About this time some of the more flourishing of the town and city lyceums began to pay the traveling expenses and even to occasionally offer a small fee for the services of some bright particular star of some other lyceum. Concord paid Daniel Webster $100 for a lecture and Ralph Waldo Emerson and Thoreau were in demand as attractions for special lyceum events. The custom of paying lecturers once established, a galaxy of lyceum stars soon appeared in the horizon. Among these were Starr King, Theodore Parker, Horace Greely, Edward Everett Hale, Henry Ward Beecher, Oliver Wendell Holmes, Agassiz, Lowell, James T. Fields, George W. Curtis, Edwin Whipple, Wendell Phillips and Charles A. Dana. It was about this time that the professional lecturer made his appearance. Emerson led the way, being immensely popular and may be said to have created the profession. He was soon followed by John B. Gough, Willits, Curtis, Whipple, O. W. Holmes, Bayard Taylor, W. L. Garrison and Fred Douglas. The most brilliant names in the history of American oratory began to appear on lyceum programs; among them being those of women lecturers who were later on the road to achieve national reputations. Lucy Stone, Anna Dickinson, Elizabeth Cady Stanton and Mary Livermore were among the "burning brands" of these early days of lyceum activity and enthusiasm.

Lyceum Reconstruction.— The heat of political opinion occasioned by the agitators preceding the outbreak of the Civil War and the years of the war itself destroyed fully 90 per cent of the lyceums throughout the land; and when the war was over there was little left of them but the material with which to begin building anew. Although the lyceums had fared badly they had left behind them a wonderful abundance of high class talent which was to be found, for the most part, in the East. In 1867 the "Associated Western Literary Societies" was organized for the purpose of bringing west, through the mutual efforts of the Western lyceums, the best Eastern lecturers. The first year the organization, which consisted of 110 lyceums, brought west 35 lecturers and gave them consecutive dates at much better pay than they had ever before received. The association was a success from the first, and after three years it joined hands with the American Literary Bureau of New York. The Boston Lyceum Bureau was already in the field in 1868, and the Williams Lecture and Musical Bureau began business the following year. The East had begun to outbid the West for the best lyceum talent and got it. The greatest names of the day appeared on the lyceum bureaus' bill of fare. The thorough organization of the lecture field followed and the popular lyceum stars soon found themselves in clover. Early in his career as a lecturer Mark Twain received $300 a night and Beecher $500. Among those who received $200 and upward for a single lecture were Barnum, Robert Collyer, Anna Dickinson and Gough. The Pond Bureau suddenly raised these high prices in order to secure the best talent in the field, paying Beecher $1,000 per lecture and Henry M. Stanley, just back from Africa, $100,000 for 100 lectures. Stanley's first lecture brought in almost $18,000. So great was the demand for good lecturers that there were not enough to fill the bill, and readers and musical entertainers were pressed into service. Some of the former, like Helen Potter, Mrs. Scott Siddons and Charlotte Cushman became immensely popular and were eventually as highly paid as the lecturers. Musical clubs, lyceum opera companies, concert companies and dramatic readers became a fixed part of the lyceum program; and the expenses of the bureaus arose to such high proportions that more organization was necessary to meet them. Then the advance agent, the seller of lyceum talent, was put upon the road and scores of new bureaus for the handling of lyceum talent came into the field. By the end of the 19th century these numbered over 100 and five years later they had reached 150, with thousands of entertainers of all kinds on their lists.

Chautauqua Societies came to intensify the life of the lyceum movement. By this time these societies had already neared the 500 mark, and they went on increasing rapidly and in so doing made further demands upon the efforts of the bureaus. The organization of talent into bands which gave their time, throughout the summer season, to the summer Chautauqua followed, and the selling of bureau talent became the business of trained agents who completely covered the country.

Out of these Chautauqua courses sprang University Extension work with its many ramifications; and the free lecture courses furnished by schools, colleges, other institutions, cities and towns. Of these the most noted are the free lecture courses of the New York City board of education. Boston, Chicago, Milwaukee, Philadelphia and other large American cities have been active along this line. The natural result of all this activity was the organization, in 1903, of the International Lyceum Association in Chicago, which has yearly, since that date, held meetings of several days' duration in some prearranged city, such as Philadelphia, Elkhart, Ind., Valparaiso, Ind., and Chautauqua. The lyceum movement early extended to Canada where it became very active, established talent-selling bureaus and perfected its own organizations. (See UNIVERSITY EXTENSION; CHAUTAUQUA SOCIETIES; LITERARY SOCIETIES; NEW YORK CITY FREE LECTURES; INTERNATIONAL LYCEUM ASSOCIATION). Consult the biographies of Beecher, Gough, Emerson and other noted lecturers mentioned in this article, *Lyceum Magazine, Lyceum World,* and Wright, A. A., ‹A Brief History of the Lyceum› (in ‹Who's Who in the Lyceum,› Philadelphia 1906).

JOHN HUBERT CORNYN,
Editorial Staff of The Americana.

LYCEUM MOVEMENT, an educational project launched by Josiah Holbrook at Millbury, Mass., in 1826. Its primary object was to establish lyceums in various cities to stimulate educational institutions and ventures along three lines: (1) the improvement of the public schools; (2) the organization of libraries and museums; (3) the formation of lecture courses and the establishment of classes for the education of adults. The movement became exceedingly popular, especially in regard to the second and third purposes. Noteworthy monuments testifying to the work accomplished are the Lowell Institute and the Mercantile Library Association in Boston, and the Brooklyn Institute. The American Lyceum Association was organized to further the plans of the movement. It was active in stimulating a live interest in the public school question, in introducing new subjects and equipment into the school curricula; furthering education of girls and women and correlating the work of the secondary schools with that of higher institutions of learning. A number of lyceum bureaus were established to serve as central offices for making arrangements for speakers, exhibits, etc., and for the gathering of information for lyceum centres. The school work of the lyceum movement is carried on largely to-day by the various education and teachers' associations; its program for the education of adults has been absorbed and enlarged by the Chautauqua and University Extension (qq.v.) movements and various women's and civic clubs; and the American Library Association has taken over the work of establishing libraries.

LYCH-GATE. See LICH-GATE.

LYCHNIS, lĭk'nĭs, a genus of plants of the pink family (*Silenaceæ*) comprising many species well known both as weeds in waste places throughout the northern hemisphere, and as garden ornaments. They have a five-toothed naked calyx, five clawed petals, 10 stamens, and five styles, with flowers generally in terminal corymbs. Ragged Robin, or cuckoo-flower (*L. flos-cuculi*), a native of Europe, is often cultivated and sometimes runs wild in the United States; white campion (*L. alba*) is another species naturalized from Europe; as also are the red campion (*L. dioica*), and some others. Many foreign species are cultivated in gardens, among which are the scarlet lychnis (*L. chalcedonica*) and the mullein-pink (*L. coronaria*). Several species are indigenous to Arctic North America.

LYCIA, lĭs'ĭ-ạ, Asia Minor, an ancient maritime province, bounded by Caria on the west, Pamphylia on the east and Pisidia on the north. Its fertility and populousness are attested by the 27 cities mentioned by Pliny, which formed a confederated republic, with a congress which regulated the public concerns, and a president called the Lyciarch. Lycia was colonized by the Greeks at a very early period, and its historical inhabitants were Greeks, though with a mixture of aboriginal blood. They and the Cilicians were the only people west of the Halys whom Crœsus did not conquer, and they were the last who held out against the Persians. Consult Fellows, ‹Account of Discoveries in Lycia› (1841).

LYCIDAS, lĭs'ĭ-dạs. A pastoral elegy contributed by John Milton to a memorial volume published at Cambridge in 1638 in honor of Edward King, a prospective parish priest, who, while on a voyage to Ireland, perished in a shipwreck off the Welsh coast in August 1637. Little is known of Milton's relations with King or of the circumstances attending the writing and publishing of ‹Lycidas,› but there is evidence that the poet bestowed much pains upon his elegy which has come to be regarded as a masterpiece in its kind, being practically unsurpassed in English poetry in rich beauty and noble harmony. Tennyson told Edward FitzGerald, who seems to have shared the opinion, that ‹Lycidas› «was a touchstone of poetic taste.»

In kind the poem holds by the pastoral elegies of the ancients, Theocritus, Bion, Moschus, Virgil and of their Renaissance imitators, but it dispenses with some typical features, e.g., the refrain, and it swells, particularly in the passage that introduces Saint Peter denouncing the corruption of the English clergy, to an ode-like intensity of lyric utterance that might warrant the claim that in 'Lycidas' Milton created a new form of elegy, one blending the primary poem of lamentation with the pastoral and the ode. The exceptional features to be observed in the verse-lengths and the rhymes, which show Italian influence, give color to this view. Few poems better repay the student who is interested in the sources from which a great poet draws his materials, but such study of 'Lycidas' only enhances respect for Milton's art and leaves his right to be regarded as essentially original unimpaired.

Admirers of 'Lycidas' have found difficulty in keeping their praise within bounds, but it has not lacked detractors, the most conspicuous of whom is Dr. Johnson. Hostile criticism is generally based on the artificial elements of the poem, which it shares with other pastorals, on the alleged lack of a deep personal interest on the part of the elegist in the subject of his elegy, and on the assumed incompatibility of the denunciatory passage on the clergy with the soft, pensive tone of regret which should characterize an elegy. The first objection applies, however, to poems like 'Adonais' and 'Thyrsis,' for example, and opens up the large topic of the place of the conventional in art; the second overlooks the possibility that Milton sincerely lamented the loss of King in his public capacity as a man who might have done service as a reformer of the Church; the third may perhaps be parried by asking whether, if Milton did thus lament King, the much-censured Saint Peter passage is not the natural culmination of a blended ode and pastoral elegy, of a fusion of kinds of poetry which has successfully borne the best of all tests, that of the experience of lovers of poetry throughout nearly three centuries. 'Lycidas' in the judgment of so many readers stands so supreme among English poems of moderate length that depreciation of it will probably, as time goes by, become negligibly sporadic.

William P. Trent.

LYCIUM, a genus of shrubby and thorny, erect or climbing plants of the *Solanaceæ* family, about 75 species of which are scattered throughout the temperate and warm parts of the world. Of the American species none is noteworthy except one naturalized from Europe called box-thorn or matrimony-vine (*L. halimifolium*), which bears funnel-form flowers, purplish changing to greenish, and red berries.

LYCOMEDES, lĭk-ō-mē'dēz, legendary king of the island of Scyros. He was the son of Apollo and Parthenope, and Thetis gave to him the charge of her son, Achilles, disguised in woman's apparel, to prevent his going to the Trojan War.

LYCOPERDACEÆ, lī"kō-pĕr-dā'sē-ē. See Fungi.

LYCOPHRON, lī'kŏf-rŏn, Greek poet and grammarian: b. Chalcis, Eubœa, 3d century B.C. He lived at Alexandria, under Ptolemy Philadelphus (283–247), whose favor he won by the invention of anagrams. Of all his writings there remains but one tragedy, 'Cassandra' (Alexandra), written in iambics. It has no pretensions to poetical merit, and is but a cumbrous store of learning and obscure allusions. It is, properly speaking, a continued soliloquy, in which Cassandra predicts the fall of Troy, and the fate of all the heroes and heroines who shared its ruin. It affords some information of value respecting antiquities and mythology.

LYCOPODIALES. See Ferns and Fern-allies.

LYCOPODIUM, the principal genus of club-mosses (q.v.), containing many species of the northern hemisphere, of which several belong to the United States. They are low creeping evergreen plants. A common example is the ground-pine (*L. clavatum*), which creeps upon the ground in heathy tracts with long, branching stems. *L. rubrum* is a violent cathartic, and has been used successfully in Spanish America in cases of elephantiasis. *L. clavatum* and *L. selago* excite vomiting. The yellow powder contained in the spore-cases of all the species is very inflammable, and is employed in the manufacture of fireworks and in the flashing of torches or production of mimic lightning on the theatrical stage. It is also employed to cover pills, so as to prevent them being acted upon by moisture, and is known in England under the name of lycopode or vegetable brimstone, and in Germany as *Blitzmehl* or *Hexenmehl* (lightning meal or witches' meal). Many of the species are prized for their beauty, and are cultivated in hothouses or fern-cases, where they thrive well.

LYCURGUS, lī-kėr'gŭs, Spartan lawgiver; flourished in the 9th century B.C., according to the commonly received traditions. He was the youngest son of the Spartan king Eunomus. His eldest brother, Polydectos, succeeded his father in the government, but died soon after. His wife proposed to Lycurgus to destroy her unborn child by her late husband, if he would share the throne with her. When she gave birth to a son, Charilaus, Lycurgus proclaimed him king, and became his guardian. Being desirous of examining the political constitutions of other lands, Lycurgus left Sparta. On his return the entire community requested him to draw up a constitution for them, and he undertook the task. The old constitution was completely remodeled; the highest position in the state was to be shared by two kings, whose powers were counterbalanced by a senate (*gerousia*). The people obtained a voice in public affairs. The native race or Lacedæmonians were confined to the pursuits of trade, commerce and agriculture; the Helots or slaves to all those menial employments which a freeman would consider as a disgrace; while the Spartans became the warriors of the state. Lycurgus also introduced a redistribution of property. Obtaining from the god at Delphi an approving oracle for his institutions, he exacted a promise from his countrymen not to make any alterations in the laws before his return from a journey he was about to make. He then left Sparta, determined to finish his life in voluntary exile in order that the Spartans might be bound by their oath to preserve his constitution inviolate forever. The time and place of his death are unknown.

LYCURGUS, one of the 10 Attic orators: b. Athens, 396 B.C.; d. there, 325 B.C. He was a pupil of Plato and of Isocrates. In 343 he was sent with Demosthenes on an embassy to counteract the intrigues of Philip. He won his chief glory as guardian of the public revenue 338–326 B.C. The decree of the Athenians commending his administration of this trust (307 B.C.) is still extant. He was also appointed superintendent of the city, and censor, and in the latter capacity caused his own wife to be fined for violating one of his sumptuary enactments. Of the prosecutions which he conducted, the most celebrated was that against Lysicles, who had commanded the army of Athens at Chæronea; Lysicles was condemned to death. There were 15 orations of his extant in the ages of Plutarch and Photius, but all have since perished except that against Leocrates, and some fragments. Consult Jebb, R. C., ‘The Attic Orators’ (3d ed., Oxford 1907).

LYDDA, Palestine, town mentioned under the name Lod several times in the Old Testament; later known as Diospolis. It is about nine miles east of Joppa and appears to have been built mostly by the Benjaminites, though considerably outside of their territory, being within the confines of Ephraim and on the road to Jerusalem. The place gained importance under Vespasian and finds a description as a village equalling a city in size by Josephus. Here Peter healed Æneas and a church was erected to commemorate the event. Cestus Gallus (65 A.D.) burned down the town but it was soon rebuilt. Ecclesiastical annals tells us this place became the seat of a bishop, being especially distinguished as the probable birthplace of the celebrated Saint George and assuredly his burial-place, a handsome church at some uncertain date being erected there to his honor. At present this town, spelled generally Ludd, is a village only of considerable size and is surrounded by fine gardens and orchards.

LYDDITE, a high explosive which was adopted by the English government in 1888 for charging its torpedo-shells. Its composition has been varied from time to time, but a typical formula is picric acid 88 per cent, dinitrobenzene 8 per cent and vaseline 4 per cent. These materials are melted and mixed together in a water-bath, and while in the fused condition they are poured into the shells, where, on cooling, they solidify to a stone-like mass, bright yellow and bitter to the taste. A central canal is left in the explosive charge in which is placed a detonator containing ammonium picrate by which the charge is exploded. Its fumes are suffocating and it is supposed to kill by shock, or suffocate. It is stable under varying temperatures. This explosive was practically tested in the Boer War and the results were very disappointing, mainly because the positions selected by the Boers were such as minimized its destructiveness. It is, however, still believed to be an efficient explosive for use against armor. The explosive owes its name to the fact that the first experiments made with it were carried on in the environs of the village of Lydd in England.

LYDEKKER, Richard, English naturalist: b. 1849; d. 16 April 1915. He was educated at Cambridge University and was a member of the staff of the Geological Survey of India 1874–82. He prepared for the British Museum in 1884, a catalogue in 10 volumes of the fossil mammalia, reptilia and birds therein, and was in Argentina, 1893–94, to examine the mammals in the La Plata Museum. Among his numerous publications are ‘Phases of Animal Life’· ‘Geographical History of Mammals’; ‘The Deer of All Lands’ (1898); ‘Wild Oxen, Sheep and Goats of All Lands, Living and Extinct’ (1898); ‘Descriptions of South American Fossil Animals’; ‘The Game Animals of India, Burma and Tibet’; ‘The Game Animals of Africa’; ‘The Sportsman's British Book’ (1908); ‘Mostly Mammals: Zoological Essays’ (1903); ‘The Ox and Its Kindred and the Sheep and Its Cousins’ (1912).

LYDGATE, lĭd'gāt, **John,** English monk and poet: b. Lydgate, Suffolk, about 1370; d. Bury Saint Edmunds, about 1450. After studying at Oxford, and visiting France and Italy, he entered the monastery of Bury Saint Edmunds, and established a school for instructing the sons of the aristocracy in versification and composition. He began to write about 1400. His chief works are his ‘The Falls of Princes’ (1430; first printed 1494); ‘Story of Thebes’ (1420); and ‘Histoire, Siege, and Destruction of Troye’ (1412–20). His minor poems were published by the Percy Society in 1840. Ritson, in his ‘Bibliographia Poetica,’ gives a complete catalogue of his works. Lydgate was an admirer of Chaucer, whom he imitated in ‘The Story of Thebes,’ a Canterbury tale in 10 syllabled couplets. An edition of his ‘Troy Book,’ edited by Berg was published at Oxford in 1906.

LYDIA, lĭd'ĭ-ạ, Asia Minor, the name of an ancient large and fertile country, inhabited along the coast of the Ionian Sea by the Ionians. Toward the south it was separated from Caria by the Mæander (now Meinder); toward the east it was bounded by Phrygia and on the north by Mysia. It was in early times a kingdom, divided from Persia by the river Halys (now Kizil Irmak). Its original inhabitants were a people called Mæonians, either of Semitic or of Indo-Pelasgic origin. This race was subdued by the Lydians, a Carian tribe. It attained its highest prosperity under the Mermnadæ dynasty, beginning with the semi-mythological Gyges (716 B.C.), and ending with Crœsus (546 B.C), who was conquered by the Persians under Cyrus. The people were the richest and perhaps the most effeminate in all Asia. They delighted in luxurious garments, costly carpets, precious ointments and exquisite viands, and a kind of Grecian music called the Lydian. They also laid out beautiful gardens. Their example corrupted the Ionians. The wealth of the Lydians, however, was probably, in a great measure, confined to the kings and chief men. These could fill their coffers with the gold washed down by the Hermus (now Sarabat) and the Pactolus, and that obtained from the mines; and they procured all the necessaries of life by the labor of their slaves. The Lydians are said to have been the first to coin money and to establish inns; they are credited with the invention of certain musical instruments, the art of dyeing wool (which was afterward carried to such perfection in Miletus), also the art of melting and working ore. At Sardis, the capital of the country, the

Grecians, Phrygians and even the nomadic tribes bartered their goods. There was here a great market for the slave-trade, which furnished the harems of Persia with eunuchs. The great tumuli graves of the ancient Lydian kings are still to be seen near the Gygæan Lake. Interesting Lydian inscriptions have been unearthed by American and other excavators. Consult Ramsay, Sir W. M., 'Historical Geography of Asia' (London 1890).

LYE, lī, a solution of an alkali; water impregnated with alkaline salt imbibed from the ashes of wood. It is largely used in soapmaking.

LYELL, lī-ĕl, SIR **Charles**, English geologist: b. Kinnordy, near Kirriemuiĕr, Forfarshire, Scotland, 14 Nov. 1797; d. London, 22 Feb. 1875. He was educated at Oxford, and on leaving Oxford he studied and passed for the bar. His life was almost wholly given, however, to geology. His first writings on the subject consisted of contributions to the 'Transactions' of the Geological Society, of which he was secretary, 1823–26, and president in 1835–36 and 1849–50, and to which he continued to furnish papers throughout his life. His first important work, and the one on which his fame rests, 'The Principles of Geology,' appeared in three volumes in 1830–33. A portion of it subsequently formed the basis of a separate work, 'The Elements of Geology' (1838). In the prosecution of his geological studies Lyell made four visits to North America, in 1841–42, 1845–46, 1852 and 1853. His 'Travels in North America' (1845) and 'Second Visit to the United States' (1849), although mainly devoted to geological topics, contain many entertaining sketches of political and social life and institutions. On the occasion of his first American visit he lectured before the Lowell Institute in Boston, and again 1845–46. In 1863 appeared Lyell's last important and most popular work, 'The Antiquity of Man,' containing a summary of all the facts and arguments that could be obtained from geology, archæology, etc., to prove that man had existed upon the earth at a period vastly more remote than usually believed. His student's 'Elements of Geology' appeared in 1871. In 1864 he was president of the British Association. In 1848 he was knighted, and in 1864 was created a baronet. Lyell was a strong supporter of the "uniformitarian" theory of geology — the steady and long-continued action of forces still at work around us — as opposed to those who believe in great cataclysms or convulsions having taken place in the past; and he assisted materially in preparing the ground for the acceptance by scientists of Darwin's theory of evolution. Consult 'Life, Letters and Journals of Sir Charles Lyell' (1881); Geikie, 'The Founders of Geology' (1897).

LYGODIUM. See FERNS AND FERN-ALLIES.

LYKENS, lī'kĕns, Pa., postal village in Dauphin County, at the foot of Bear Mountain, about 35 miles north-northeast of Harrisburg. Its rich anthracite coal mines are its chief source of income, but it has hosiery mills and a paper-box factory, foundry, etc. A bank and two newspaper offices are located here and no less than seven churches. The population in 1910 was 2,943.

LYLY, lĭl'ĭ, **John**, English author: b. about 1554; d. London, 30 Nov. 1606. He was graduated from Magdalen College, Oxford, in 1573; studied also at Cambridge; wrote plays for the children's companies of the Chapel Royal and Saint Paul's, London; took side with the bishops in the Mar-Prelate controversy; and sat in Parliament for Hindon in 1589, for Aylesbury in 1593 and 1601 and for Appleby in 1597. It is, however, for his 'Euphues' (Part I, 'Euphues, the Anatomy of Wit,' 1579; Part II, 'Euphues and his England,' 1580) that Lyly is best known. This work is a tedious narrative of the fortunes and interests of a young Athenian, and is remarkable for a prose style that exhibits a uniform and continuous affectation of epigram and antithesis. This fashion of writing, styled 'Euphuism,' was much in favor at the court of Elizabeth, influenced numerous writers and may fairly be assumed to have been ridiculed by Shakespeare, and it has excited the derision of successive generations of authors. Lyly's plays, 'Alexander and Campaspe' (1584), 'Endymion' (1591) and 'Midas' (1592), contain some worthy lyrics. Consult Bond's edition of his works (3 vols., London 1902); Child, C. G., 'John Lyly and Euphuism' (ib. 1894); Feuillerat, A., 'John Lyly: Contribution à la histoire de la Renaissance ou Angleterre' (Paris 1910); Wilson, J. D., 'John Lyly' (Cambridge, Eng., 1905).

LYMAN, lī'măn, **Benjamin Smith**, American geologist and mining engineer: b. Northampton, Mass., 11 Dec. 1835. He was educated in the common schools, followed by one year of private tuition, then by one year at Phillips Exeter Academy and three years at Harvard College, receiving the degree of A.B in 1855. Taught school a few months, as principal of Deerfield (Mass.) Academy, and as assistant in Short's Classical School at Philadelphia, and in Sanborn's school at Concord, Mass. In 1856 he went to live at Philadelphia. In 1857 traveled extensively in the Middle and Southern States, collecting statistics of the iron manufacture for the American Iron Association. In 1858 he took up geology for life work and became assistant geologist of the State of Iowa. In 1859–61 he studied at the Paris École des Mines, and then spent a year at the Freiberg Mining Academy. Returning to Philadelphia, he resumed work at geological surveys in Pennsylvania, Virginia, eastern Nova Scotia, California, Alabama and Lower Canada, often in collaboration with J. P. Lesley, his original preceptor in such work, and, like him, based his work on instrumental topographical surveying. About 1866 Lyman devised the method of indicating the geological structure, the direction and steepness of the dip and the height of rock beds above sea-level, or other given level, at every point, by means of curves equidistant in level upon the surface of the rock beds. About four years later he devised a method of most compactly marking on maps the observed direction and steepness of dips at different points, so that any number of them could be clearly marked without confusion. In 1870 he was employed by the government of India in surveying oil fields. In 1871 he patented a solar transit surveying instrument, and in 1872 resumed geological surveys in West Virginia. From 1873 to 1879 he was employed by the Japanese government as chief geologist and mining engineer, first in a geological survey of Yesso (ascertaining an extensive coal field); then in a survey of the oil lands on the main island and examining many mines, and finally in beginning the geological survey of Japan. The surveys were economical in character, and moreover resulted in training a dozen young students to become capable practical geologists. The survey required traveling in every considerable part of Japan, but the winter headquarters were at Tokio. Returning in 1881 to America, he went to live at his native town, and resumed the practice of private geological surveys in Pennsylvania, Ohio, New Mexico and Colorado. In 1885 and 1886 he served as common councilman of the city of Northampton. In 1887 he returned to Philadelphia and began, for the Pennsylvania State Geological Survey, a geological survey of the New Red of Bucks and Montgomery counties, of which the results were finally published in 1895. He determined the thickness of the New Red to be about 27,000 feet, over five times as much as it had previously, after 75 years' discussion, been generally conjectured to be; and he demonstrated the fact by a map with a couple of thousand dips marked, and the structure of the rock beds fully indicated in conformity with them by equidistant curves, and with the outcrop of important building stone beds marked for many miles through the country. In 1906 he went for a six months' trip to the Philippines to investigate coal lands on the island of Cebu. Since that other private geological work in Pennsylvania has claimed his attention. He has published over 150 reports and papers on geological surveying and other subjects. He is an honorary member of the Engineers' Club of Philadelphia and of the Japan Mining Institute and member of many other societies.

LYMAN, Chester Smith, American astronomer: b. Manchester, Conn., 13 Jan. 1814; d. New Haven, 29 Jan. 1890. In youth he was self-taught in astronomy and other branches of science, making for himself serviceable apparatus. He calculated eclipses 15 years ahead and computed almanacs for 1830–31. He was graduated at Yale in 1837 and studied theology there after a previous course at Union Theological Seminary. After a short pastorate (1843–45) at New Britain, Conn., he went to the Hawaiian Islands, where he became instructor at the Royal School. Two years later he was surveying in California. In 1850 he returned to the East and resumed his early study of sciences; in 1858 accepted the professorship of industrial mechanics and physics at Yale; from 1871 to 1884 was professor of astronomy and physics in the Sheffield Scientific School, which he had assisted in organizing, and continued to teach astronomy alone until 1889 when he became professor emeritus. He made a number of useful scientific inventions, including a combination zenith telescope and transit for latitude, longitude and time, and was a contributor of papers to the *New Englander* and the *American Journal of Science*.

LYMAN, Phineas, American soldier: b. Durham, Conn., about 1716; d. West Florida, now Mississippi, near Natchez, 10 Sept. 1774. He was graduated at Yale in 1738, was tutor there until 1741 and subsequently practised law in Suffield. He acquired a great legal reputation and succeeded in having Suffield annexed to Connecticut. He was a member of the upper house of the Connecticut legislature from 1749 to 1755. In the latter year he was appointed major-general and the same year, being commander-in-chief of the Connecticut militia, he served with Sir William Johnson at the battle of Lake George, and, after his commander had been disabled, conducted the engagement to a prosperous conclusion. He constructed Fort Edward, which at first was known as Fort Lyman, but the name was changed by Johnson, who was jealous of Lyman's popularity. He was present at the attack upon Ticonderoga by Abercrombie and at the capture of Crown Point and the surrender of Montreal, and in 1762 commanded the provincial troops in the expedition against Havana. Subsequently he passed many years in England in efforts to procure a grant of land on the Mississippi for the purpose of establishing a colony, and in 1774 embarked with his eldest son and some others for the country in question. The emigrants who followed him encountered many misfortunes, and after the subjugation of the country by the Spaniards in 1781–82 were obliged to take refuge in Savannah.

LYMAN, Theodore, Amercan philanthropist: b. Boston, 20 Feb. 1792; d. Brookline, Mass., 18 July 1849. He was graduated from Harvard in 1810, studied at the University of Edinburgh in 1812–14, was for a time aide-de-camp to the governor of Massachusetts, in 1823–27 commanded the Boston brigade of the State militia with rank of brigadier-general, was a representative in the State legislature in 1821–24, and became State senator in 1824. In 1834–35 he was mayor of Boston. He opposed the radical Abolitionists, and in August 1835 presided over a pro-slavery meeting in Boston, but on 21 Oct. 1835, at the risk of his own life, rescued William Lloyd Garrison from the «gentlemanly mob» that had vowed to bring the Abolitionist to the tar-kettle before dark. In order to save him he had him confined to jail. From 1835 he devoted himself to philanthropic work, and in 1844 removed to Brookline, Mass. In 1840–46 he was president of the Boston Farm School. To this institution he gave $10,000; to the Massachusetts Horticultural Society, of which he was a life-member, $10,000, and to the State Reform School, now the Lyman School, at Westboro, $72,500. He wrote 'Three Weeks in Paris' (1814); 'The Political State of Italy' (1820); 'The Hartford Convention' (1823), a defense of the Conventionists; 'The Diplomacy of the United States with Foreign Nations' (1828), a work still of use for the period covered.

LYMAN, Theodore, American naturalist: b. Waltham, Mass., 23 Aug. 1833; d. Nahant, Mass., 9 Sept. 1897. He was a son of Theodore Lyman (1792–1849) (q.v.). He was graduated from Harvard in 1855, from the Lawrence Scientific School in 1858, and was assistant in zoology at the Museum of Comparative Zoology. In 1863–65 was volunteer aide on the staff of General Meade, with rank of lieutenant-colonel. Having been mustered out on 20

April 1865, he was fish commissioner for Massachusetts in 1865–82, and in that capacity made the first experiments undertaken by any State of the Union for the cultivation and protection of food-fishes. In 1883–85 he served in Congress as an independent representative. He was also president of the Boston Farm School, a member of the National Academy of Sciences (from 1872), and a trustee of the Peabody education fund. He donated $10,000 to Harvard and his library of scientific works to the Museum of Comparative Zoology. His most important researches were connected with the Radiata. Among his publications are 'Illustrated Catalogue of the Ophiuridæ and Astrophytidæ in the Museum of Comparative Zoology' (1865), with a 'Supplement' (1871); 'Old and New Ophiuridæ and Astrophytidæ' (1869); 'Papers Relating to the Garrison Mob' (1870); 'Prodrome of the Ophiuridæ and Astrophytidæ of the Challenger Expedition' (1878–79), and 'Report on the Ophiuridæ Dredged by H. M. S. Challenger during the Years 1873–76' (1882).

LYME REGIS, līm rē'jĭs, England, seaport town in Dorsetshire, at the mouth of the Lyme at its entry to the English Channel, and 22 miles west of Dorchester. It is a favorite summer bathing resort and its record goes back at least to the 13th century as a town. There is a Gothic (Saint Michael's) church, old town-hall, assembly rooms, custom house, etc. The harbor has two piers which form it into a basin useful for small craft in stormy weather. Its population in 1911 was 2,772. In 1664 the town was besieged by Prince Moritz of the Palatinate, and it was here that the Duke of Monmouth landed in 1685. An ichthyosaurus and a plesiosaurus were discovered in this section buried in the Lias rock. Consult Roberts, 'History of Lyme Regis' (London 1834).

LYMPH, the fluid contained in the lymphatic glands and in the lacteals (q.v.). It is elaborated primarily by the assimilation of food, and is also obtained from the blood and tissues, the system of vessels in which it is contained ramifying throughout the bodies of vertebrates. The clearest and simplest view of the nature and functions of the lymphatic vessels is that which considers them as forming a connecting-link between the digestive and circulatory systems. It is to be understood that the largest portion of all the cells in the body never comes in direct contact with the blood, which itself touches only the linings of the veins and arteries and the cells of the pulp of the spleen. What builds up the tissues of the body is not therefore the blood, but the lymph. Also the waste matters which are formed in the tissues are collected by the lymph, which turns it over to the blood, from which it is carried to the lungs, kidneys, skin, etc., from which it is excreted. The matters absorbed from the alimentary canal and from the blood and tissues are converted in the lymphatic glands into lymph, which supplies initial and essential elements of the blood. The lymphatic system, concerned in absorption, is also called the absorbent system. None of the invertebrates have such a defined set of vessels; in the lower animals matters pass from the digestive system into the blood-system directly and without the intervention of any absorbent vessels. The lymphatic vessels constitute a distinctive character of the highest sub-kingdom of animals. Fresh supplies of nutritive matter are poured from the lymphatic system into the current of circulation, but it is difficult, if not impossible, to determine where the function of circulation ends and that of absorption begins. Hall, experimenting upon a patient from whom an accident permitted the chyle to be taken, found that the fat contained in it varied according to the diet, while the protein and sugar varied very little.

The lymph as it exists in the lymphatic vessels of a fasting animal is a colorless, transparent fluid, odorless, with a slightly saline taste and an alkaline reaction. Four kinds of lymph are recognized: (1) the tissue lymph which fills the spaces between the cells in all parts of the body; (2) circulating lymph which flows along the lymph vessels and returns to the blood system; (3) chyle, which is a circulating lymph in the intestines, and (4) the serous lymph which the serous cavities contain. When microscopically examined it is seen to be a clear plasma containing corpuscles. It resembles blood in being an alkaline fluid, and in that it coagulates or clots by the separation of the fibrinous part of the plasma; but it differs from blood in that its corpuscles are nearly all colorless, and because its solid matters are present in very small proportions. Excepting chyle, all lymph is about 95 per cent water, the rest being made up of about 3.75 per cent of proteins, 0.1 per cent of extractives and a very small proportion of inorganic matter. In chyle the water is about 90 per cent. The lymph-corpuscles, when passed into the current of the blood, by a simple change of medium become the white blood-corpuscles, and when partially altered they give origin to red corpuscles. The lacteals absorb the chyle directly from the alimentary canal, and pour it, as rudimental blood, into the current of the circulation. Then from the body generally the ordinary lymphatic vessels bring the lymph, which is further elaborated in the lymphatic glands, and pour it into the current of the blood. The actual termination of the lymphatic vessels is in the large veins in the neighborhood of the heart. The lymphatic circulation may thus be regarded as corresponding in its general direction to the course of the venous blood.

The lymphatic vessels resemble small veins in their general structure. They are provided with valves permitting the flow of the lymph only toward the large veins near the heart and into which the lymph is poured. The only structures in which lymphatic vessels do not exist are the non-vascular parts, such as the hair, nails, outer skin and cartilaginous tissues. The flow of lymph toward the heart is induced partly by the general pressure and action of the muscles of the body, the valvular structure aiding its propulsion as in the veins; and to this, as well as to the absorptive power, must be added the action of the contractile muscular fibres of the lymph-vessels themselves. It is not known to what extent the flow of lymph may be under the direct control of the nerves.

The fluid employed in vaccination (q.v.) is also called lymph, of which two varieties are distinguished, human and bovine. The term has likewise been applied to various serums made from bacterial cultures for preventive or curative use in certain diseases, especially to those serums known as antitoxins (q.v.). (See IMMUNITY; KOCH, ROBERT; SERUM, THERAPY; TUBERCULOSIS.

LYMPHATIC GLANDS, small organs, round and smooth and comparatively solid, which form part of the lymphatic system in vertebrates. (See LACTEALS; LYMPH). Into these, sooner or later in their course, the other lymphatic vessels run, and from them emerge again. The lymphatic glands are highly important structures, since only after passing through them does the lymph contain, in any abundance, lymph-corpuscles. In size the glands may be compared to small almonds, and they are generally arranged in groups. Each gland is entered by a number of afferent vessels which bring lymph to it, while those (efferent vessels) which leave the gland carry lymph away from it. Externally a lymphatic gland presents an envelope of connective tissue, from which the stroma, consisting of a fibrous framework of processes, is prolonged into the interior of the gland. Within the stroma the essential gland-structure is contained. Within the stroma also, as well as within the softer portions or pulp contained in the meshes of the fibrous network, minute blood-vessels are distributed. Corpuscles are added to the lymph in the glands, while in the composition of its fluid it undergoes further elaboration. The lymphatic glands are regarded as factories of leucocytes or white blood cells. The lymphatic trunks of the greater part of the body finally pour their contents into the thoracic duct, a small tube which opens into the current of the blood at the point of junction of the internal jugular and subclavian veins of the left side of the body. On the right side of the body is a still smaller duct which receives the contents of the lymphatics of the right half of the chest, the right arm and the right side of the head and neck; and this smaller lymphatic channel or right lymphatic duct opens into the angle formed by the junction of the right jugular and subclavian veins, similarly to its larger neighbor of the left side. The thoracic duct begins in the upper part of the abdomen and runs up in front of the spine to the root of the neck, where it opens into the great veins. The receptaculum chyli, or cistern of the chyle, is the dilation at the commencement of the thoracic duct in the abdomen, which receives the contents of the lacteals or intestinal lymphatics. The orifices by which the thoracic duct and right lymphatic duct open into their respective great veins are guarded by valves which permit the lymph to flow from the ducts into the veins, but prevent the flow of blood into the ducts.

The spleen has been considered by physiologists to be merely a ductless lymphatic gland of large size, since it appears to be concerned in the elaboration of the blood, and also to be a place of disintegration of the red corpuscles and a manufactory of the white corpuscles of the blood. And the thymus, another ductless gland, has also been supposed to be connected with the function of blood-elaboration, and thus to be associated with the lymphatic system.

LYNCH, Anne Charlotte. See BOTTA, ANNE CHARLOTTE.

LYNCH, Arthur, Irish journalist and author: b. Smythesdale, Ballarat, Victoria, Australia, 1861. He was educated at Melbourne University and the University of Berlin; practised as an engineer, lectured on engineering and scientific subjects at Melbourne; was for a time a journalist in London; was a war correspondent in Ashanti, and twice visited America. During the second Boer War he was colonel in the Irish Brigade No. 2 of the Transvaal forces, and upon his landing in Great Britain subsequent to the war was brought to trial for high treason. He was sentenced to death; but this sentence was afterward commuted to life imprisonment. Lynch was elected member of Parliament for Galway in 1901. Among his books are 'Modern Authors' (1891); 'Approaches' (1892); 'Our Poets' (1895); 'Religio Athletæ' (1895); 'Human Documents' (1896); 'Prince Azreel' (1911); 'Sonnets of the Banner and the Star' (1914), and 'Ireland: Vital Hour' (1915).

LYNCH, Charles, American planter and soldier: b. Chestnut Hill, Va., 1736; d. 1796. He was one of the pioneers of Bedford County at 19. In 1767 he was elected to the House of Burgesses. His influence was thrown in favor of the Revolution and it is in great part due to him that the Virginia delegation was sent to Congress with instructions that culminated in the Declaration of Independence. He became justice of the peace in 1774 and colonel of militia in 1778. He lived on the Staunton River in Virginia, and in support of the Revolutionary government in that region during the early part of the war with Great Britain, joined Robert Adams and Thomas Calloway in the punishment and exile of Tories. As justice of the peace, he sentenced them to various terms of imprisonment in order to prevent their acting against the Revolutionary movement. A frequent punishment, so says tradition, was to suspend the disaffected by their thumbs until they were willing to exclaim "Liberty forever!" The summary acts of this self-appointed court are generally accepted as the origin of the term lynch-law (from "Lynch's Law"). But whereas the expression is now used almost exclusively of punishment by death without legal authority, it does not appear that Lynch ever exacted the death penalty. After the surrender of Yorktown, Lynch returned to Bedford County, and the Tories threatened to prosecute him for his activities against them which were in excess of his powers. On Lynch's appealing to the legislature, the latter branded his actions as illegal, but exonerated him in view of the circumstances.

LYNCH, Frederick (Henry), American clergyman and educator: b. Peace Dale, R. I., 21 July 1867. He was graduated (1894) at Yale University, taking the B.D. degree in 1897. In 1899 he was ordained to the Congregational ministry, becoming assistant pastor of the United Church, New Haven, Conn., 1896–98, and pastor of the Pilgrim Church, New York, 1904–10. He has been editor of *Christian Work and Evangelist* since 1908; executor and director of the New York Peace Society; founder of the Peace Arbitration Society of New York, and delegate to the International peace congresses at Munich (1897) and London (1908); also secretary of the Church Peace Union of America. He has written 'The Enlargement of Life' (1903); 'Is Life Worth Living?' (1905); 'The Gospel for To-Day' (1905); 'The Peace Problem' (1911); 'New Opportunities of the Ministry (1912); 'What Makes a Nation Great?' (1913); 'The Last War' (1915); 'The Challenge' (1917); 'The Christian in War Time' (1917). Numerous magazines have published short stories and articles from his pen.

LYNCH, James Mathew, union labor leader: b. Manlius, N. Y., 11 Jan. 1867. He was educated at his native town (1874–81), then entering the printing trade. He has been active as a leader in union labor circles, serving for seven terms as president of the Syracuse Trade Assembly, and filling the positions, successively, of first vice-president (1899–1900), and president (1900–14) of the International Typographical Union. At present he is a member of the New York State Industrial Commission, member of the National Civic Federation and of the American Association for Labor Legislation.

LYNCH, John Joseph, Canadian Roman Catholic prelate: b. Ireland, 1816; d. 1888. He was educated at Dublin and Paris, was ordained to the priesthood in 1843 and three years later came to the United States. He next went to Canada, where he became coadjutor bishop of Toronto in 1859, bishop in 1860 and archbishop in 1870.

LYNCH, Patricio, Chilean naval and military officer: b. Santiago, Chile, 1824; d. at sea, May 1886. He was educated at the Chilean Naval Academy; entered the English navy in 1840 and took part in the Anglo-Chinese War; in 1847 he re-entered the Chilean navy and served during the war against Spain and became governor of Valparaiso. In 1879–80 he commanded a military and naval expedition against Peru, and ravaged the northern part of that state, destroying a large amount of property. He also took part in the battle of Chorrillos, the battle of Miraflores and the attack against Lima, and was made commander-in-chief of the Chilean army; in the city of Lima he strictly observed martial law, suppressed the Peruvian government and took Calderon, the provisional President, prisoner, though this act called forth a protest from the United States Minister. In 1883 he evacuated the city, having placed Iglesias at the head of affairs. He was made vice-admiral of the navy, and in 1884 sent as Minister to Spain. He died on his homeward voyage two years later.

LYNCH, Thomas, Jr., American patriot, one of the signers of the Declaration of Independence: b. Prince George's parish, S. C., 5 Aug. 1749; perished at sea in the latter part of 1779. He was educated at Eton and the University of Cambridge, and was subsequently admitted as a student in the Temple, London. In 1772 he returned to South Carolina, and at the outbreak of hostilities in 1775 was appointed a captain in the first regiment of provincial regulars raised by South Carolina. Being unanimously chosen by the provincial assembly to succeed his father as a member of Congress, he took his seat in that body in 1776, but in a few months was compelled by ill health to retire from active political life. One of his last public acts was to affix his signature to the Declaration of Independence. In the latter part of 1779, as the only means of saving his life, he sailed for Saint Eustatius, West Indies, intending to find there a neutral vessel which would convey him to France. The ship in which he sailed was never heard from and is supposed to have been lost in a storm.

LYNCH, William Francis, American naval officer: b. Norfolk, Va., 9 April 1801; d. Baltimore, 17 Oct. 1865. He entered (1819) the United States navy, becoming lieutenant in 1828. A Palestine expedition was placed in his command (1848) and he explored the Dead Sea and the Jordan, publishing (1849) an account of the survey under the title of 'Narrative of the United States Expedition to the River Jordan and the Dead Sea,' which has gone through several editions. He was promoted (1849) commander and (1856) captain, in which latter rank he joined the Confederate forces in 1861, in which he rose to commodore. He wrote also 'Naval Life: The Midshipman, or Observation Afloat and Ashore' (1851).

LYNCH LAW, or JUDGE LYNCH, a name for irregular punishment, especially capital, inflicted by private individuals independently of the legal authorities. Extra judicial punishments in states which are in a condition of loose organization have been common in all ages, as the *Vehngerichte* in Germany, the Lydford law in England, «Jeddart Justice» in Scotland and the Spanish *Hermanadad*. The origin of the term «Lynch law» is doubtful; by some it is said to be from James Lynch Fitz-Stephen, warden of Galway, Ireland, who, about 1526, sentenced his son to death for murder, and to prevent a rescue by a mob executed him with his own hands without due process of law. By others the term is said to have had its origin in the State of Virginia, where a farmer of the name of Charles Lynch (q.v.) took his own way of obtaining redress for a theft by catching the culprit, tying him to a tree and flogging him. This mode of administering justice has always prevailed more or less in every country in times of great popular excitement, and is necessarily resorted to in newly-settled territories, where the power of the civil government is not fully established. As early as 1768, in the United States the terms «regulating,» «regulation» and «regulator» were in use in the Carolinas; illegal whippings were at that time inflicted by the Regulators, and it is claimed that a meeting of the Regulators took place at Lynch's Creek. Whether there is any historical connection between the Regulators of the Carolinas and the Regulators who flourished along the Western frontiers where lynch law was well known, in and after 1819, is one of the many obscure points in the early history of lynch law which await elucidation. At first in the United States, «lynch law» was not mob law, as it is now understood. It was almost necessary under the conditions then obtaining, when territory extended faster than effective government organization for the punishment of offenders. It was orderly, methodical and fair in its practices, and was strongly opposed to violence or mob rule. Its distinctive feature was simply that its decrees and findings were executed sternly and swiftly on the spot where they had been decided upon. This was true of the conditions in California in 1849 when Judge Lynch held frequent court, and hundreds of culprits were executed between 1849 and 1860, in an orderly manner, with nothing of the mob violence or excitement common in recent years. During the Civil War and afterward, lynching was practised in the Southern States at the instigation of the Ku Klux Klan (q.v.). From 1870 it became an unwritten law in the South to lynch by mob rule every negro charged with rape or assault, or with the murder of a white person; and it is still the Southern States that bear the unenviable record for lynchings. Gradually this practice spread to Northern States, and negroes were not only «lynched,» or hung, but were burned at the stake in Indiana, Illinois, Ohio and other States. According to figures prepared by the Chicago *Tribune*, there were 3,539 lynchings in the United States between 1885 and 1912. About one-third of these were for violence to women, another third for murder, but none were for the killing of one negro by another. The number of lynchings vary considerably from year to year, as the following totals show: in 1906, 68; 1907, 71; 1912, 64; 1913, 79; 1914, 50; 1915, 96; 1916, 54. In the last-named year 50 negroes were lynched and four whites; less than a quarter of the punishments being inflicted for rape. Georgia headed the list of lynchings for 1916 with 14, Florida had 8 and Oklahoma 4.

Rarely is there conviction or punishment of persons who participated in lynchings, owing largely to the sympathy of jurors for the accused. In Kansas and Indiana laws have been passed providing for the suspension from office of sheriffs who fail to protect prisoners from the violence of the mob, and in South Carolina and Ohio the counties are held liable for compensation to the relatives of persons who suffer death by lynching. As the administration of the criminal law is in the hands of the several States, the Federal government is unable to mitigate or stamp out the practice. The best remedy for lynch law is prompt action by the courts and the prompt execution of sentence after a culprit has been convicted. Consult Calter, J. E., ‘Lynch Law’ (New York 1905); Hart, A. B., ‘The Southern South’ (ib. 1910); ‘Cyclopædia of American Government,’ ed. by McLaughlin and Hart (New York 1914); and the volumes of the ‘American Year Book.’

LYNCHBURG, Va., city Campbell County, on the James River and on the Norfolk and Western, the Southern and the Chesapeake and Ohio railroad 174 miles south-southwest of Washington. The city is situated in a river valley which forms a pass through the mountains. The irregularity of the surface upon which stands the city, the hills, the numerous terraces, the many trees along the streets, the well-built, handsome houses with neatly kept grounds, all make the place most attractive.

History.— Lynchburg was founded in 1786 by John Lynch, but it was not incorporated until 1823. It was early in the 19th century, as now, a distributing centre for places above on the river and for many settlements and towns south of the James. The Confederates used it as a supply depot during the Civil War. On 18 June 1864 General Hunter, of the Federal army, attacked the city, but was defeated.

Manufactures, etc.— The chief manufactures are iron products, tobacco, cotton goods, plows, wagons, shoes, bark extract, candy, fertilizers, overalls, hardware, flour and lumber. It has extensive tobacco interests, as a manufacturing and jobbing centre being among the seven leading shoe jobbing centres of the Union. The trade is principally in tobacco, raw and manufactured; coal, granite and its own manufactures. Lynchburg is the seat of Randolph-Macon Woman's College, Virginia Christian College (coeducational) and Episcopal School for Boys, and it has four hospitals, the Miller Female Orphan Asylum, a Presbyterian orphanage, an Odd-Fellows' orphanage, Y. M. C. A., Y. W. C. A. and Chamber of Commerce. Granite quarries are near by, and large coal fields and iron ore are in the neighboring counties. The river furnishes extensive water power, which aids in the development of the manufacturing interests of the city.

Government, etc.— The government of the city is vested in a mayor, who holds office four years, and a council and board of aldermen (biennial). The city treasurer, clerk of the courts and commissioner of revenue are chosen by popular election, and the other officers are appointed. The waterworks plant is owned and operated by the city. Pop. about 29,494. Consult Cabell, ‘Sketches and Recollections of Lynchburg.’

LYNDE, lĭnd, **Francis, American novelist**: b. Lewiston, N. Y., 12 Nov. 1856. After many years in the railway service in various capacities he turned to literature in 1893, beginning as a contributor to magazines; work which he still continues and which now comprises over 200 short stories and novelettes. His published books are ‘A Romance in Transit’ (1898); ‘The Helpers’ (1899); ‘A Private Chivalry’ (1900); ‘The Master of Appleby’ (1902); ‘The Grafters’ (1904); A Fool for Love’ (1905); ‘The Quickening’ (1906); ‘Empire Builders’ (1907); ‘The King of Arcadia’ (1909); ‘The Taming of Red Butte Western’ (1910); ‘The Price’ (1911); ‘Scientific Sprague’ (1912); ‘The Honorable Senator Sage-brush’ (1913); ‘The City of Numbered Days’ (1914); ‘The Real Man’ (1915). With a single exception, Mr. Lynde's books deal with modern conditions of American life, industrial, social and political, with a strong emphasis laid upon character development.

LYNDHURST, lĭnd'hėrst, **John Singleton Copley, Baron, English lawyer and statesman**: b. Boston, 21 May 1772; d. London, 12 Oct. 1863. His father was the well-known painter of the same name. He was taken to England in early infancy, his parents having gone to reside in London. He was educated at the University of Cambridge, became a Fellow of Trinity College, traveled in the United States, was called to the bar at Lincoln's Inn in 1804 and soon gained a high position. In 1817 he ably defended Watson and Thistlewood for high treason, and obtained their acquittal. He was first known as a Liberal, but early became Conservative. In 1818 he entered Parliament for Yarmouth, Isle of Wight, which he soon exchanged for Ashburton. In 1819 he became solicitor-general and was knighted. He conducted the prosecution in the trial of Queen Caroline. In 1824 he succeeded to the post of Attorney-General, in 1826 was elected for Cambridge, and became Master of the Rolls. He succeeded Lord Eldon as Chancellor in 1827, which post he retained until 1830, and was raised to the peerage as Baron Lyndhurst. In March 1829, he delivered a great speech against Catholic emancipation. He was chief baron of the exchequer from 1831–34. He was a formidable opponent of the Reform Bill, and in 1834 became a second time Chancellor, but in 1835 retired with the Peel Ministry. Lyndhurst's speeches and annual reviews of the session contributed greatly to the return to power of the Conservatives in 1841, on which occasion he was a third time raised to the woolsack. He retired in 1846, from which time he took little part in home politics, confining his attention more to matters of foreign policy. For a long time he was virtually the Tory leader in the upper house. Brougham said: «Lyndhurst was so immeasurably superior to his contemporaries . . . that he might well be pardoned for looking down rather than praising.» He was distinguished alike as a debater, advocate and judge; his decisions were models in arrangement and clearness of exposition. Consult Sir Theodore Martin's ‹Life› (1883); Atlay's ‹The Victorian Chancellors› (London 1906); and, for a spiteful portrayal, Campbell's ‹Lives of the Chancellors.›

LYNDON, Vt., post-village of Caledonia County, located on the Passumpsic River, about 36 miles east by northeast of Montpelier. It has two churches, an academy, graded school, national bank, two marble works, pulp-mill, an institute, school of agriculture, public library, etc. Pop. about 3,204.

LYNE, lĭn, **Joseph Leycester,** commonly known as «FATHER IGNATIUS,» or «IGNATIUS OF JESUS,» English clergyman: b. London, 23 Nov. 1837; d. 16 Oct. 1908. After taking deacon's orders in the Church of England and doing mission work in London, he conceived the idea of reviving the Benedictine rule in a modern monastic foundation. With this view he first formed a community at Claydon, near Ipswich, in 1862 and finally built Llanthony Abbey in Wales, where he was joined by a few enthusiasts, though his movement made no progress at all commensurate with his program. He visited Canada and the United States (1890–91) as a missioner. He was a striking preacher, and his warmly evangelical discourses were in curious contrast to his mediæval ideas. But he was always in conflict with the authorities of the Church of England, was finally prohibited from preaching and was forced to preach in hired halls. Among his published works are ‹The Catholic Church of England› (1864); ‹Brother Placidus› (1870); ‹Leonard Morris, or the Benedictine Monk› (1871); ‹Mission Sermons and Orations› (1886); ‹Jesus Only› (1889).

LYNN, lĭn, **Samuel H.,** American physician: b. Philadelphia, 1843; d. Rochester, N. Y., 27 Feb. 1917. He was a graduate of the School of Dentistry of the University of Pennsylvania and of the School of Medicine there. He removed to Rochester in 1888. He spent much of his time abroad, and for 18 years lived in Russia. He studied at the clinics in Vienna, Saint Petersburg and other European cities and obtained a world-wide knowledge of medicine. He was a veteran of the Civil War, having served under Admiral Farragut at the battle of Mobile Bay and participated in the Cushing expedition. He was one of the men who planted a bomb on the deck of the *Albemarle.* He was a member of several medical societies.

LYNN, lĭn, Mass., city in Essex County, on Massachusetts Bay, and on the Boston and Maine, the Boston, Revere Beach and Lynn railroads, about 10 miles northeast of Boston and five miles southwest of Salem. Area, nearly 12 square miles. Lynn was first settled in 1629 by Edmund and Francis Ingalls and for a time was called Saugus. It receives its present name in 1637 from King's Lynn, England, the home of Samuel Whiting, then pastor at Saugus (Lynn). It was incorporated in 1630 and chartered as a city in 1850. The city includes what were several independent villages: Glenmere, Highlands, East Lynn, West Lynn, Linwood, Lynmere and Wyoma. The Lynn Harbor is shallow, but it is considered safe. The three-mile shore-line adds to its attractions. The city is noted for its shoe factories. The annual amount of shoe business is in the neighborhood of $50,000,000; and the number of persons employed, about 25,000. The chief manufactures are shoes, cut leather, shoe machinery, electrical supplies, meters, arc lamps, morocco and patent medicines. The city has several churches of the various denominations. Some of the principal buildings are Lynn Public Library, which has about 65,000 volumes; two hospitals, the city hall, Lynn Home for Aged Women and an orphanage. There are two high schools, over 100 grammar schools and an equal number of primary schools, together with several large parish schools, containing primary, grammar and high school departments.

The annual expenditure for municipal maintenance and operation is about $1,348,000; the chief items are, schools about $385,000; for poor, sick, homeless and other charities, $63,000; for police department, $112,000; for fire department, $112,000; for waterworks, $185,000; for sanitation, $104,000. The waterworks plant opened in 1870, and costing about $2,500,000, is owned and operated by the city.

The government of Lynn is conducted on the commission plan. Pop. about 98,207. Consult Newhall, F. H., ‹History of Lynn, Mass.› (Lynn 1883), and Sanderson, H. K., ‹Lynn in the Revolution› (2 vols., Boston 1909).

LYNN EPISCOPI («Bishop's Lynn»), a seaport town in the county of Norfolk, England, situated on the Great Ouse near its mouth; and generally known as King's Lynn (q.v.).

LYNN REGIS, KING'S LYNN, a port town in Norfolk, England, situated on the Great Ouse, not far from its mouth. See KING'S LYNN.

LYNX, a wildcat, distinguished from the larger members of the family *Felidæ* chiefly by the shortness of the tail and the presence of a pencil-like arrangement of hairs at the tips of the ears. It was long customary to regard these cats as constituting a separate genus *Lynx,* to which the North American wildcats, the caracal and some others, were assigned, but modern zoologists include them with the general genus *Felis*. (See Wildcat). The fur known to trade as "lynx" is furnished by the Canadian lynx, and is described as of a light-brown color, with a light silvery top on the back, that on the under part long, soft and spotted; about 30,000 to 80,000 are exported yearly from the Dominion of Canada, California and Alaska to Liverpool, besides what is consumed in domestic trade.

LYON, David Gordon, American Assyriologist: b. Benton, Ala., 24 May 1852. He was graduated from Howard College, Alabama in 1875, and at Leipzig in 1882. From 1882 to 1910 he was Hollis professor of divinity at Harvard, and since the latter year has been Hancock professor of Hebrew and other Oriental languages. Since 1891 he has served as curator of the Harvard Semitic Museum. He was recording secretary of the American Oriental Society 1886–95; corresponding secretary of the Society of Biblical Literature 1894–99, and director of the American School for Oriental Study and Research 1906–07. He is a Fellow of the American Academy of Arts and Sciences. He has published ‘Heilschrifttexte Sargons Königs von Assyrien’ (1883); ‘An Assyrian Manual’ (1886), and articles in the *Journal* of the American Oriental Society.

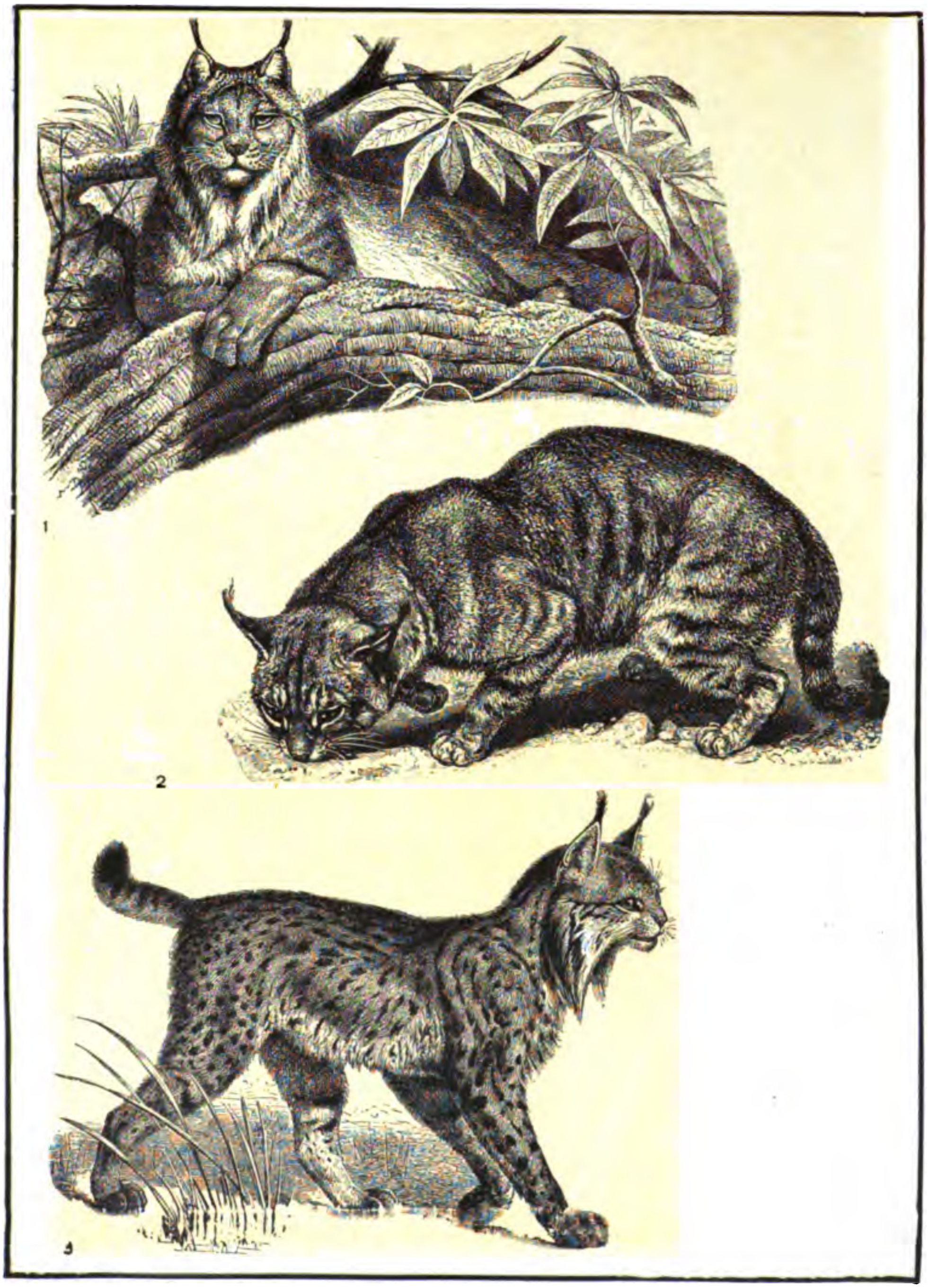
LYON, George Francis, English naval captain and traveler: b. Chichester, 1795; d. at sea, 1832. He entered (1808) the navy and was commissioned (1818–20) to travel in Africa for the government. From 1821–23 he was a member of Captain Parry's Arctic expedition, and (1824) he attempted with the *Griper* to reach Repulse Bay, but was unsuccessful. In 1826 he went to Mexico and South America. He wrote ‘A Narrative of Travels in North Africa’ (1821); ‘Journal of a Residence and Tour in the Republic of Mexico’ (1829).

LYON, Mary, American educator: b. Buckland, Mass., 28 Feb. 1797; d. South Hadley, Mass., 5 March 1849. She began teaching at 18, and later studied at the Sanderson Academy, Ashfield, and at the Byfield Academy, near Newburyport, continuing to teach at intervals. In 1821 she began teaching at the Sanderson Academy, and in 1824 became associate principal of the Adams Female Academy at Londonderry, N. H, In 1828, with the principal of this school she moved to Ipswich, Mass., where they were followed by a number of their pupils, and established a seminary of which Miss Lyon had practically the entire charge for several years. The establishment of a seminary for girls, embodying the same principles of education as the Ipswich school, and at the same time offering its advantages at a low price, became the main purpose of her life; and in 1834 she resigned her position at Ipswich, and, amid great discouragements, undertook the work of founding such a seminary. Aided to some extent by clergymen and others, she succeeded in obtaining contributions, and on 8 Nov. 1837, a part of the buildings having been completed, the school was opened in South Hadley with about 80 pupils, under the name of the Mount Holyoke Female Seminary. She was president of this school for 12 years, during which time it was enlarged and gained a national reputation for its high intellectual and moral standard. (See Mount Holyoke College). She wrote ‘Tendencies of the Principles embraced and the System adopted in the Mount Holyoke Female Seminary’ (1840) and the ‘Missionary Offering’ (1843). Consult Hitchcock, Edward, ‘Life and Labors of Mary Lyon’ (New York 1860); Gilchrist, B. B., ‘Life of Mary Lyon’ (Boston 1910); Foster and Adams, ‘Heroines of Modern Progress’ (New York 1913); Nutting, M. O., ‘Historical Sketch of Mount Holyoke Seminary’ (Washington 1876).

LYON, Matthew, American politician: b. Wicklow County, Ireland, 1746; d. Spadra Bluff, Ark., 1 Aug. 1822. He went to New York in 1755, and, being too poor to pay for his passage, was bound out by the captain of the ship to a farmer in Connecticut, in whose service he remained a number of years. Subsequently he became a citizen of Vermont, and in July 1776 was commissioned as lieutenant in one of the companies of "Green Mountain boys." He served later as commissary-general, and eventually rose to the rank of colonel of militia. He was one of the founders of Fairhaven (1783), where he engaged in paper-making, iron casting and other occupations, and at one time edited a newspaper of an ultra-democratic character, entitled *The Scourge of Aristocracy and Repository of Important Political Truth,* of which the types and paper were manufactured by himself. Becoming an active political leader, he was elected in 1797 to Congress by the Anti-Federal party. In October 1798 he was convicted of a libel on President Adams, and imprisoned for four months, a fine of $1,000 which had also been imposed upon him being paid by his friends. An attempt to expel him from Congress as a convicted felon failed for want of a two-thirds vote. During this Congressional term he had a violent altercation on the floor of the House with Roswell Griswold of Connecticut, ending in blows; but the motion to expel them was defeated. In 1799, while a prisoner, he was re-elected to Congress from Vermont. After the expiration of his term he removed to Kentucky, where at the next Congressional election (1803) he was returned to the House, of which he continued a member until 1811. Subsequently he held the office of United States factor for the Cherokee Indians by the appointment of President Monroe and removed to Arkansas, of which he was the territorial delegate-elect to Congress at the time of his death. Though rough and impetuous in manner, he was an able debater, and to the end of his life continued a man of active business habits. He built gunboats on speculation during the War of 1812 and lost his fortune in the venture. Consult Bassett, J. S., ‘The Federalist System’ (New York 1906); Channing, Edward, ‘The Jeffersonian System’ (ib. 1906); McLaughlin, ‘Matthew Lyon, the Hampden of Congress: A Biography’ (ib. 1900).

LYON, Nathaniel, American soldier: b. Ashford, Conn., 14 July 1818; d. Wilson's Creek, Mo., 7 Aug. 1861. He was graduated from West Point in 1841; served in the Mexican War 1846–47, being present at the siege of Vera Cruz and the assault on the City of Mexico; and was on duty in Kansas during the Free State agitation. In February 1861 he was assigned to Saint Louis, Mo., where he had charge of the arsenal; he was most active and efficient in the Union cause, organized the Home Guard

LYNXES



1 Canada Lynx **2 European Lynx** **3 Chaus**

and on 10 June 1861 captured Camp Jackson, a rendezvous of the seccessionists. Soon afterward he was made brigadier-general of volunteers and given command of the department. He refused all compromise with Governor Jackson, who sympathized with the secessionists, and in June occupied Jefferson City, the capital of the State, and defeated the governor's troops at Boonville on the 17th. He then went to Springfield, whence he advanced on 1 August to meet a part of the Confederate army, which was advancing into Missouri under McCulloch; he defeated them at Dug Spring and returned to Springfield. But the Confederate forces were soon increased by the arrival of the troops under Price and General Lyon was opposed by an army considerably greater than his own. Unwilling to surrender southwestern Missouri without a struggle, he decided to risk a battle and accordingly advanced from Springfield to Wilson's Creek, where his troops were defeated and he himself killed after a gallant fight. He bequeathed nearly all his property, about $30,000, to the government to aid in the preservation of the Union. In 1862 a collection of his letters in favor of the Republican party and the election of Lincoln (1860) was published under the title 'The Last Political Writings of General Nathaniel Lyon.' Consult Carr, Lucien, 'Missouri: A Bone of Contention' (New York 1888); Hosmer, J. K., 'The Appeal to Arms' (ib. 1907); Rhodes, J. F., 'History of the United States from the Compromise of 1850' (ib. 1907); 'Life' (Hartford 1862) by Woodward; Peckham, 'General Nathaniel Lyon and Missouri in 1861' (New York 1866); and Churchill's novel, 'The Crisis.'

LYONNESSE, lī'ō-nĕs, **LYONESSE, LEONAIS, LEOMOYS**, England, the land from which King Arthur came and now submerged «forty fathoms under water» or, as in Tennyson's 'Morte d'Arthur': «Until King Arthur's table, man by man, had fallen in Lyonnesse about their lord,» we find it the «last battle field of the West,» scene of the final conflict between Arthur and Sir Modred, west of Camelot, sometimes located near Cornwall, between Land's End and the Scilly Islands.

LYONS, Richard Bickerton Pemell, English diplomat: b. Lymington, Hampshire, 26 April 1817; d. 5 Dec. 1887. He studied at Winchester College and Christ Church, Oxford, taking (1843) the degree M.A. He had been appointed (1839) attaché at Athens without pay, but in 1844 he was in government's pay at that city, to be transferred to Dresden in 1852. The following year he was transferred to Florence, becoming secretary of that legation in 1856. From 1858–65 he was British Minister at Washington, and then (1865–67) Ambassador at Constantinople. He was Ambassador at Paris from 1867–87. He was created Viscount Lyons of Christchurch in 1881, and Earl Lyons in 1837. His wonderful tact and broadness of vision were oftentimes displayed while he represented the Court of Saint James in Washington. This was the trying period of the Civil War, calling for much tact, especially during such an episode as the Mason and Slidell release controversy.

LYONS, lī'ŏnz, or **LYON**, lē-ôṅ, France, the former capital of Lyonnais and now of the department of the Rhône, 320 miles by rail southeast of Paris, and 170 miles north of Marseilles, is the second city of industrial and military importance and the third in point of population in the country. It is strikingly situated at the confluence of the Saône and Rhône, the central business section being on the tongue of land that projects between the rivers to their junction, and extends northward to the hill of La Croix Rousse; while the ancient mediæval town is on the steep slopes of the Fourvières hill, rising from the west bank of the Saône, and the modern industrial suburb of La Guillotière, with its numerous factories, is on the east bank of the Rhône. Thirteen bridges span the Saône at this point, varying from 250 to 450 feet wide, and 11 bridges the Rhône, over 600 feet wide. A series of detached forts crown different heights within a circuit of 43 miles, making Lyons, with its extensive barracks and considerable garrison, a defensive position of great strategic importance. It is the centre for the 14th Army Corps. The older quarters of the town are crowded, dirty and unhealthful, with narrow, irregular streets, lined by tall, ungainly buildings. The best parts are the 13 miles of magnificent quays, built since the 18th century as a protection against the periodical river floods, and now laid out with finely planted walks, stately mansions, municipal buildings, railroad depots, capacious warehouses, etc.

Among the notable squares and open places are the Place des Terreaux, facing which stands the Hôtel de Ville and the large and handsome Place Bellecour, the fashionable promenade. The chief public edifices are more remarkable for their antiquity than for the beauty of their architecture. The cathedral of Saint John on the slope of the Fourvières, on the right bank of the Saône, is in the Gothic style of the 12th century, and has four towers, two of which flank the west front, while the other two, shorter but more massive, form the transepts. Higher up the slope is the modern church of Notre Dame, an imposing composite edifice occupying the site of the *Forum Vetus* built by Trajan. Beside it is a tower or Belvedere 680 feet above the Saône from which on a clear day Mont Blanc, 100 miles off, may be seen. On the other side of the Fourvières is the church of Saint Irenæus, the second bishop of Lyons. The church itself is an uninteresting modern structure, but it stands on the grave of the martyred bishop, and has beneath it the reputed crypt in which Polycarp preached, and 19,000 Christians at a later period were massacred by orders of Septimius Severus, 202 A.D. A little above the cathedral is the Palais de Justice, and lower down on the opposite bank of the Saône is the church of the Abbey of Ainay, dating from the 6th century, beneath whose sacristy, and penetrating below the bed of the river, are dungeons without light or air, in which many of the early Christians were immured previous to martyrdom. Other noteworthy churches are the church of Saint Nizier, of the 14th century, one of the largest in the town; that of Saint Bonaventure, the patron saint of Lyons; and the church of the Chartreux, surmounted by a superb dome seen from all quarters of the city. The archepiscopal palace (15th century), situated near the cathedral, is a large edifice of no architectural merit. The Hôtel de Ville is considered one of the finest edifices of the kind in France. It is an isolated square, and is surmounted by a dome 164 feet high. The public library, occupying part of the buildings of the college on the Quai de Retz, is the best provincial collection in France, containing 450,000 volumes and over 1,000 incunabula. The Palais des Arts, facing the Place des Terreaux, is a fine majestic edifice. It contains a picture-gallery (with works by Pugin, Rubens, Paul Veronese and Teniers), a museum of natural history, a cabinet of medals, a gallery for statutes, and another for ancient stuccoes, a depot of mechanical inventions for the fabrication of silks, with a library attached, a free school of design and a large hall used as the exchange. Among the city's monuments are those to President Carnot, a memorial of the Franco-German War and a fountain by Bartholdi.

The chief educational establishments are the college, or university, founded 1808, occupying a fine modern building and attended by over 3,000 students in the different faculties; the Martinière, a great school of science and the industrial arts with 500 students; a free Catholic university; various institutions of a special character, such as schools of chemistry and chemical industry, schools of design, of commerce, of weaving; a celebrated veterinary school, the botanic garden, etc. Charitable establishments are large and numerous. The most important are the Hôtel-Dieu, the Maison de la Charité, the Mont de Piété, occupying the Manécanterie or deanery attached to the cathedral; and the Hospice de l'Antiquaille, on the site of the ancient Roman palace or prætorium now used partly as a lunatic and partly as a Magdalen asylum, and general penitentiary. There are several prisons — the New Prison, an extensive building, well arranged; the Maison des Récluses, now employed as a military prison; and the prison of Roanne, regarded as a model of its kind.

As a manufacturing town Lyons early acquired and has long maintained a first place. It is a great financial centre, with very large foreign investments. One of its great institutions, the Crédit Lyonnais, has branches in 100 cities of France. It is the most important centre of silk manufacture in the world, employing directly and indirectly over 200,000 persons. Other manufactures are hats, boots, jewelry and liqueurs; besides dye-works, foundries, glass-houses, potteries, tanneries, breweries, chemical works and printeries. Lyons, albeit the climate is foggy and rainy, is admirably situated for trade, on two navigable rivers, which make it a great entrepôt both for the north and the south. It forms the common centre where the highways and railroads from Paris, Marseilles, Bordeaux, from Switzerland and Italy, all meet; it communicates with the Rhine by the Rhône and Rhine Canal, while several other canals, branching off from its rivers, give it ample means of transport over a great part of the interior of the country. The chief imports are raw silk, wine, brandy, oil, soap, flax, hemp, rice, salt, cotton, wool, coffee, dyes, earthenware and timber; and the exports, spun-silk and silk-goods ribbons, hats, straw-bonnets, woolens, flannels, linens, corn, flour, chestnuts, liqueurs, paper, hemp, ironware, etc. The United States is represented by a consulate.

As Lugdunum, Lyons was an early Gallic town, and when Cæsar invaded Gaul was a place of some importance; it figures more or less in the subsequent history of the Roman Empire, several emperors in succession making it their occasional residence and vying with each other in adorning it. It early received Christianity, and toward the end of the 2d century numbered thousands of Christians, among its inhabitants. Its first bishop, Pothinus, died a martyr in 197, and his successor, Irenæus, died also a martyr in 202. Lyons was afterward sacked by the Huns and Visigoths, who destroyed many of its noblest Roman structures. In the 8th century it fell for a time into the hands of an army of Saracens from Spain, and suffered severely; but recovered its prosperity under Charlemagne, on the dissolution of whose empire it became the capital of the kingdom of Provence. Subsequently it fell under ecclesiastical domination, and was long governed by a succession of archbishops. Two Ecumenical Church Councils were held in the city (1245—74). In 1312 Lyons was annexed to the crown of France. It received its first municipal charter in 1320. It owes its new quays and several of its finest edifices to Louis XIV, of whom there is a fine equestrian statue. The Revolution of 1793 occasioned fearful reverses. The inhabitants, finding their industry paralyzed and their trade destroyed, rebelled against revolutionary violence, and the convention let loose its forces upon them; wholesale butcheries for many days deluged the town with blood. Since that period questions of an economical, or rather socialist nature, culminated in the sanguinary revolts of 1831, 1834, 1849 and 1871. Several important figures in history were natives of Lyons, among them the Roman emperors Marcus Aurelius, Claudius and Caracalla, and the celebrated general Germanicus, Saints Irenæus and Ambrose, and Meissonier the artist. Pop. about 523,796.

LYONS, Kan., city, county-seat of Rice County, on the Atchison, Topeka and Santa Fé, the Missouri Pacific, the Saint Louis and San Francisco railroads, about 180 miles west by south of Topeka and 25 miles north by west of Hutchinson. It is situated in a fertile agricultural region, in which stock-raising is a prominent industry. Nearby are salt deposits, like that at Hutchinson in Reno County, a remarkably fine salt, obtained from a considerable depth below the surface. Some of its industrial establishments are salt works, grain elevators, gas-engine works and flour-mills. Its trade is chiefly in grain, salt, livestock, flour and corn. The city owns and operates the waterworks. Pop. about 1,071.

LYONS, N. Y., village, county-seat of Wayne County, on the Erie and new Barge Canal system. Is 49 miles west of Syracuse and 36 miles east by south of Rochester. On the main line of the New York Central, West Shore and Rochester, Syracuse and Eastern railway systems, being the terminal of the Pennsylvania division of the New York Central, tapping the Pennsylvania coal fields. Lyons was founded in 1795 and incorporated as a village in 1854. It is situated in a fertile agricultural region and centre of the fruit belt. The Niagara, Lockport and Ontario Power Company maintains a large power plant here, furnishing the Empire United Railways with power and surrounding villages with current for all purposes. The Empire Gas and Electric Company maintains its power plant here, utilizing an extensive water power. The Barge Canal will have warehouses and terminals here costing $125,000. It is estimated that 15,000 horse power can be realized from the Barge Canal at this point. State officials estimate that one-third of the local tonnage on the Barge Canal will be received at this point, being coal to be transferred here from the Pennsylvania coal fields. The New York Central has extensive car shops here with a payroll of over $800 per day. Lyons has the cheapest electric power in the State of New York outside of Niagara Falls. This is an important coal transfer point, the New York Central transferring here, while the Philadelphia and Reading Coal and Iron Company has a mammoth coal transferring trestle in the Pennsylvania division yards.

Its chief industries are two of the largest canning plants in the State; a large cider vinegar plant, cement pipe and block factory; tile yards, machine shops, planing mill, distilleries of peppermint and other essential oils. Mail bags, sacks, carriers' bags, satchels and straps for the United States postal system are made here with a factory for making fanning-mills and slipper soles.

The Lyons Cold Storage Company, Incorporated, recently erected a 75,000-barrel cold-storage plant here, the only plant of its kind between Syracuse and Rochester on the main line of the New York Central. There are extensive warehouses for the handling of fruit and produce of various kinds. Lyons has been made a grading station for handling hay from the Western States and grading it for shipment. A warehouse has just been completed for receiving, grading and picking beans, giving employment to 60 hands, using power machinery. A new municipal waterworks plant costing $100,000 and a sewer system with disposal plant costing $140,000 has been installed the past year. Tax rate and fire insurance rates are low. The mortgage indebtedness of Lyons is the smallest of any village in the Empire State, while the fact that its mortality rate is the lowest of any New York village and 78 per cent of its residences are occupied by owners speaks well for the frugality of its residents. The Hough Shade Corporation of Janesville, Wis., maintains storage warehouses here, supplying the New England, Middle and Eastern States to and including Washington, D. C. Lyons has an aggressive Business Men's Association and Civic Club. The union school library with over 7,000 and the Civic Club library with over 3,000 books are maintained. Its school system is of the best.

LYONS, Councils of, two synods held at the city in France from which they derive their name and which are received as ecumenical by the Roman Catholic Church. When the quarrel between the Emperor Frederick II and Innocent IV had resulted in the banishment of the latter from Rome, the Pope summoned a council in 1245 at which the patriarchs of Aquileia, Antioch and Constantinople, as well as the Emperor Baldwin II, were present, with several royal delegates. Thaddæus of Susa represented Frederick II, who was, in spite of that delegate's emphatic protests, solemnly deposed and his subjects released from their allegiance. When Gregory X took the tiara, his first step was to attempt a reunion of Christendom, as represented by the Greek and Latin churches, which had been parted by schism mainly on the question of the *filioque* (q.v.), and Latin accretions to the doctrine of purgatory. Accordingly the second Council of Lyons met 1274 under his presidency and the desired union was apparently effected, for both Greek and Latin prelates sang the Creed including the clause asserting the double procession. The tie that bound them, however, proved a rope of sand and the schism has continued to this day. The synod also made regulations concerning papal elections. See GREEK CHURCH.

LYONS, Gulf of, a large bay of the Mediterranean on the south of France, extending from the Spanish frontier eastward to the Hyères Islands.

LYRE, the most ancient of stringed instruments, which originally had but three strings. The Egyptian and Grecian lyres were at first strung with the sinews of animals. The number of the strings was at last increased to 16. It was played with a stick of ivory or polished wood, also with the fingers. The body of the lyre was hollow, to increase the sound. Few objects are so graceful in form and susceptible of such various application in the fine arts. As a musical instrument it has now gone out of use among the civilized nations, though a rude form of it is still to be met with in the hands of the shepherds of Greece and among the negro tribes of Africa. It is the symbol of Apollo.

LYRE-BAT (*Megadernia lyra*), a small bat of the family *Nycteridæ*, common in India and Ceylon, where it is known as the «Vampire» bat. It haunts old buildings, ruins and cave-temples. The name vampire is given to it from its blood-sucking habits, for it first sucks the blood of its prey before consuming the body. It eats insects, smaller bats and fish. Enormous ears are characteristic of the lyre-bat. Consult Blyth, E., 'Notice of the Predatory and Sanguivorous habits of the bats of the genus *Megaderme*' (in the *Journal of the Asiastic Society of Bengal,* Vol. XI, pt. I, p. 255–262, Calcutta 1842).

LYRE-BIRD, a remarkable Australian bird which derives its name from the form of the tail in the male, which much resembles that of the conventional Apollo's lyre; the tail of the female is rather long, but simply wedge-shaped. There are two species, about the size of chickens, both reddish brown and called «native pheasants» by the colonists, constituting the genus *Menura* and family *Menuridæ,* and regarded as the lowliest of the *Passeres,* and of very ancient origin. They dwell in the «scrub» or open woods, and rarely leave the ground, avoiding their enemies by swift running. Their nests are placed upon the ground, are well woven of sticks and plant-stems and are covered by a dome-like roof, leaving an entrance only at the sides. In the mating season the males scrape up mounds of leaves and rubbish upon which they strut about, sing and do their best to display their long and handsome tails to the hens. The better known species is the long-tailed one (*M. superba*) but both are now rare.

LYRIC POETRY. The origins of lyric poetry are merged with those of narrative, because of the primitive conditions under which the distinction between these types did not exist,— that is, when there was no clearly felt difference between the relating of an incident and the expression of the emotions associated with it. With the development of art there seems to have been a gradual differentiation of lyric and narrative expression, as there was a differentiation of the originally united arts of poetry and music. The progress of poetry was, in general, marked by an increased emphasis on the individuality of the artist and on the personal or subjective elements in lyric poetry; further, by the diminished importance of its association with music, and a corresponding growth of the reflective or intellectual elements, so that modern lyric poetry is but slightly associated with actual song, though it is still centred on the expression of subjective emotion. The surviving sense of the original connection between this utterance of personal feeling and song is well illustrated by Wordsworth's observation that his lyric poems, though none of them songs, could not have their full force without a *supposed* musical accompaniment. For the various types of lyric developed from primitive song to late reflective lyric, see under LITERARY FORMS.

Song Lyric.— In Greek poetry this type is commonly called «melic,» and is distinguished according as a poem was intended to be sung by an individual or a chorus; the former class was associated especially with the Æolian race and its music, the latter with the Dorian. The principal names representative of Greek lyric are those of Terpander and Alcman, in the 7th century B.C., Anacreon, Alcæus and Sappho in the 6th century, and Pindar and Bacchylides in the 5th. It should also be remembered that the Greek drama was in large degree a lyric form, containing choral odes made for musical rendition; so that in this sense Æschylus, Sophocles and Euripides are authors of some of the greatest of ancient lyrics. From the standpoint of its later influence, the most important feature of Greek lyric was its elaborate strophic structure, adapted to corresponding musical form. Thus the threefold structure of the choral odes, divided into «strophes,» «antistrophes» and «epodes,» became the model for the few formal odes in modern poetry. The music of the Greeks and the corresponding types of lyrics were imitated by the Romans; but since the art of song held a much less important place at Rome, these types passed over into the literary lyric, and practically no examples of pure song-lyric are preserved from the period of classical Latin. In the 4th century of the Christian era occurred an important development of the *hymn*, especially under the influence of Saint Ambrose of Milan; and that form of lyric remains important to this day in connection with ecclesiastical music. From the mediæval period a great body of popular song-lyric survives, usually without association with any known author; it was also cultivated with elegant formality at the courts of princes, especially by the troubadours of Provence and the minnesingers of Swabia. In the Renaissance period this development of the art by courtly poets was continued, and in western Europe received a new stimulus under Italian influence. At the court of Henry VIII of England vocal music, both sacred and secular, was diligently cultivated, and from this period date several collections of songs; the *Bassus*, for example, printed in 1530 by Wynkyn de Worde, is one of the earliest English printed books. In Elizabethan England the connection between music and lyric poetry was maintained with enthusiasm, and musicians — courtly and otherwise — vied with each other in producing collections like William Byrd's ‹Psalms,› ‹Sonnets,› and ‹Songs of Sadness and Piety› (1588), and ‹Songs of Sundrie Natures› (1589); John Dowland's three ‹Books of Songs or Airs› (1597–1603), and Thomas Campion's four ‹Books of Airs› (1601–18). A special form called the madrigal, introduced at this period from Italy, exerted an influence on Elizabethan music and poetry alike, as is exemplified in Yonge's ‹Musica Transalpina,› a collection of madrigals from the Italian (1588), and Wilbye's ‹First Set of Madrigals› (1598). The greater number of these Elizabethan songs are of comparatively slight interest as poetry, but to this Thomas Campion is an exception, a number of his lyrics remaining classics — such as «Cherry Ripe» and «The man of life upright.» In the modern period the increasing development of the reflective and literary elements of poetry has diminished the importance of the song lyric and few important names are associated with it. Of these the greatest is Robert Burns, whose poems (published 1786 and 1793) were written for the most part as songs set to traditional Scottish airs and represent more nearly the primitive conditions of union of music and verse than any other work of modern times. Other groups of song lyrics of some importance are the ‹Irish Melodies› of Thomas Moore (1807–34) and the ‹Hebrew Melodies› of Lord Byron (1815). In Germany the chief representatives of this type are Wilhelm Müller (died 1827), Uhland (died 1862), Heine (died 1856) and Mörike (died 1875).

Reflective Lyric.— The line between this group and the preceding is often a slight or arbitrary one; but in general the reflective lyric may be distinguished as arising from meditation on a personal experience rather than from the spontaneous impulse to express it musically. In modern practice it is read rather than sung. But in ancient times, when the lyric art was more largely musical, the same distinction cannot be observed; thus many of the Greek lyrics are reflective, though intended for song. The forms of Greek poetry called «elegiac» (represented by Tyrtæus and Mimnermus) and «iambic» (represented by Archilochus) may be distinguished in this way from the «melic,» as less closely associated with song. Among the Romans the chief masters of the lyric were Catullus, in the first half of the 1st century B.C., and, in the second half of the century, Horace, Tibullus, Propertius and Ovid. Horace's most familiar poems, the «odes,» were originally called *carmina*, or songs, but appear to have been much more commonly read than sung; in the «epodes» he was less lyrical and

LYRE BIRD

more reflective. Tibullus, Propertius and Ovid are classed as the «elegiac» lyrists, but in Latin literature even more than in Greek the term has reference to traditional form rather than to distinctive subject-matter. In the mediæval period the formal lyric was less important than narrative poetry, but with notable exceptions among the courtly poets, particularly in France; to these are traced the lyrics in «fixed forms,» like the rondeau, the ballade and the villanelle. The Renaissance brought about an immense revival of literary lyric, especially in Italy under the influence of Petrarch (died 1374), and in France under the leadership of the «Pléiade poets»— Ronsard, du Bellay, etc.— of the 16th century. The most important resulting type was the sonnet, the vogue of which in France and Italy was carried into England, reaching its height toward the close of the 16th century. This, with other forms of lyric of the Italian school, was introduced to English readers by the posthumous publication, in 1557, of the poems of Sir Thomas Wyatt and the Earl of Surrey (see under TOTTEL'S MISCELLANY). In the Elizabethan period there appeared not only many collections of sonnets, but a number of poetical miscellanies indicating the growing interest in lyric poetry of a cultivated character. Of the sonneteers, the chief are Sidney, Daniel, Drayton, Shakespeare and Spenser. Spenser also contributed to the Elizabethan lyric the pastoral poems of his ‹Shepherd's Calendar,› 1579, and Drayton a brilliant collection called ‹Poems Lyric and Pastoral,› 1606. Ben Jonson, though himself a minor lyrist, exerted an important influence on the more correct or classical school of post-Elizabethan lyric; of his followers, sometimes called the «sons of Ben,» the chief representative is Robert Herrick, who in 1648 published the collections of lyrics called ‹Hesperides› and ‹Noble Numbers.› John Donne, a contemporary of Jonson's, exerted an influence of a different character, and is sometimes viewed as the founder of the so-called «metaphysical» lyric poetry of the 17th century,— that is, poetry characterized by the use of intricate and ingenious imagery drawn from the field of learning rather than art. In this century the most characteristic development of the English lyric was in the religious type; besides Herrick, already mentioned, its leading representatives are George Herbert and Richard Crashaw. The Restoration saw a brief revival of secular lyric poetry, especially of the courtly type, in the region of occasional verse and *vers de société*, but the lyric spirit was ebbing rapidly in the interest of poetry of satiric and didactic modes. In the 18th century the most characteristic English lyrics are odes like those of Collins and Gray, in which the form of the ancient classical ode, now divorced from its association with music, is made the means of elaborate poetic thinking, and equally formal and reflective elegies, of which Gray's, again, is the chief. The ode form was cultivated in France in the same period by Jean Baptiste Rousseau (died 1741) and Écouchard Lebrun (died 1807); and in both France and Germany there was also a vogue of «anacreontics,» representing another revival of classical fashion; but in general the age was one in which the lyric languished on the Continent as well as in England. With the «romantic revival,» at the end of the 18th and the beginning of the 19th century, there came a great renewal of the lyrical impulse. The emphasis placed by the romantic spirit upon individual emotion leads to the characteristic expression of such emotion in lyric form and the whole 19th century presents a new development of the effort to unite with this expression the processes of reflection. In England the finest representatives of this tendency are Wordsworth, Keats and Shelley, in the opening years of the century; Wordsworth's ode on «Intimations of Immortality,» Shelley's «Odes to Naples» and Keats' ode «On a Grecian Urn» are masterpieces exemplifying the lyric development of thought on the subjects of immortality, liberty and art. In the mid-19th century the reflective lyric finds equally notable representation in the poems of Tennyson's ‹In Memoriam› (1850). Tennyson also wrote a number of «dramatic lyrics,» — that is, lyrical utterances of imagined personalities — and the same type was developed even more brilliantly by Robert Browning. The personal sonnet-sequence was revived by Mrs. Elizabeth Barrett Browning in her ‹Sonnets from the Portuguese› (1850), and by Dante Rossetti in the collection called ‹The House of Life› (1881); and the pastoral elegy, in the manner of the classic tradition, reappeared in Matthew Arnold's ‹Thyrsis› (1866). Of the later Victorian lyrists Algernon Charles Swinburne may be counted the chief. Meantime the romantic movement had developed the reflective lyric with equal importance on the Continent. In the earlier years of the century Goethe represented it in Germany, followed later by such lyrists as Ferdinand Freiligrath (died 1876), Emanuel Geibel (died 1884), Detlev von Liliencron (died 1909), Friedrich Nietzsche (better known as philosopher, died 1900), and Richard Dehmel (born 1863). In France the chief lyrists of the century are Béranger (died 1857), Lamartine (died 1869), Alfred de Vigny (died 1863), Alfred de Musset (died 1857), Théophile Gautier (died 1872), and Victor Hugo (died 1885). Some will have it that the lyric poetry of Hugo, in its combination of personal fervor, range of intellectual interest and sensuous beauty, is unsurpassed in the verse of any modern tongue. In Italy among the more important representatives of the lyric are Leopardi (died 1837), Manzoni (died 1872), and Carducci (born 1836). American literature has not been distinguished primarily for lyric poetry, though in Edgar Allan Poe (died 1849) it has an important representative of the type which is close to song. Exemplars of the more reflective type are found in the poetry of Bryant, Longfellow, Lowell, Whittier, Emerson, Whitman, Aldrich, Sidney Lanier, Emily Dickinson, William Vaughn Moody and John B. Tabb. Perhaps the high-water marks of American lyric might be measured from three or four occasional poems which are expressive of national as well as personal feeling,— Emerson's «Concord Hymn,» Lowell's «Commemoration Ode,» Whitman's «Captain, my Captain,» and Moody's «Ode in Time of Hesitation.» It is clear that the vogue and the value of lyric poetry remain wholly undiminished; indeed it remains the characteristic type of the present era. In the early 20th century, however, there has been a tendency among the younger poets to relax the emphasis on the reflective or intellectual element, and to make the lyric a more momentary or fugitive representation of a personal mood. See POETRY.

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LYS, lēs, or **LEYE**, lī-ĕ, Belgium, an affluent of the Scheldt, which rises near Lysbourg, Pas-de-Calais, France, and after a northeasterly course of 130 miles unites with the Scheldt at Ghent, Belgium. Some of the most stubbornly contested engagements in the early months of the Great War were fought in its valley.

LYSANDER, lī-săn'dėr, Spartan general: d. 395. His father was Aristocritus, a Lacedæmonian of the purest blood, being of Heracleidan descent, his mother a Helot who brought him up in poverty. His fine qualities, however, procured him the command of the Spartan fleet off the coasts of Asia Minor (408). He established his headquarters at Ephesus, which he raised to prosperity. Next year he was succeeded by Callicratidas. In a short time his reputation had so increased that the Asiatic allies of Sparta requested the Lacedæmonians to invest him a second time with the command. Accordingly, Lysander, with the title of vice-admiral (405 B.C.), defeated and captured the Athenian fleet off Ægospotamos. This decisive victory put an end to the Peloponnesian War. Shortly afterward he set sail for Athens, which he blockaded. The city was starved into capitulation (404); the long walls and the fortifications of the Piræus were demolished; and the oligarchy of the Thirty Tyrants was established, which governed with terrible cruelty. Lysander then returned to Lacedæmon, where his ambitious and unscrupulous character made itself more palpable than ever. He was excessively fond of praise, and was the first of their own countrymen to whom the Greeks erected altars, offered sacrifices as to a god and celebrated festivals. On his return to Sparta Lysander, stung by the ingratitude of Agesilaus, whose succession to the throne he had secured, resolved to destroy the constitution of his country by abolishing hereditary monarchy, making the throne elective, but the Delphic and other oracles were unfavorable, in spite even of his bribes. On the outbreak of the Bœotian War (395 B.C.) he marched against Haliartus and was killed in battle under its walls.

LYSANIAS, (1) an Athenian of the deme Sphettus, who according to some accounts was the father of Æschines, the disciple of Socrates. Consult Plato, 'Apol'; Socrates, c. 22; Diogenes' 'Laërtius,' ii, 60. (2) The father of Cephalus, one of the interlocutors in the republic of Plato. Consult Plato, 'Polit.' p. 330b. (3) A friend of Alexander the Great, who was sent with Philotas to the coast in charge of the booty taken after the victory over the Thracians (355 B.C.). Consult Arrian, 1, 2. (4) A Greek grammarian, native of Cyrene, mentioned by Athenæus as the author of a work on the Iambic poets (vii, p. 304 b.; xiv, p. 620 c.). Suidas speaks of him as the instructor of Eratosthenes. He may be the same person mentioned by Diogenes ('Laërtius' vi, 23) as the son of Æschrion.

LYSANIAS, tetrarch of Abilene (on the eastern slope of the Lebanon Mountains near Damascus), mentioned by Saint Luke (chapter iii, 1) at the time when John the Baptist began his ministry (25 A.D.). He is supposed to have died about the time that the Emperor Claudius ascended the throne for in the first year of Claudius' reign the tetrarchy of Abilene was given to Herod Agrippa. It is probable that Lysanias was the son of Lysanias, spoken of by Josephus as a prince named Lysanias who ruled over a territory in the neighborhood of Lebanon in the time of Antony and Cleopatra and who was put to death by Antony to gratify Cleopatra (26 B.C.). This ambitious queen seems to have received a good part of the territory (Joseph, Ant. Jud. xv, 4; Dion. Cass., xlix, 32). The obscurity surrounding the name of Lysanias has attracted the attention of scholars, many of whom confused the two Lysanias supposing there was but one. Consult

McClintock and Strong (Vol. V, p. 589, New York 1891).

LYSENIAS, a piece of statuary found in the island of Scio and bearing this name on the base and an inscription showing that the sculptor's father was named Dionysus and that the statue represented the god Dionysus.

LYSIAS, lĭs'ĭ-ạs, Athenian orator: b. about 458 B.C.; d. about 380. He was a son of Cephalus, an orator, of whom Plato makes honorable mention in his 'Republic.' Lysias at 14 went to Thurium, in Magna Græcia, to study philosophy and eloquence under Tisias and Nicias of Syracuse. Having settled in Thurium, he was employed in the government; but on the defeat of the Athenians in Sicily was banished with many of his countrymen. After Athens had recovered its freedom he exerted himself for the advantage of the city and sacrificed much of his property for the public welfare. At first he gave instruction in eloquence; but finding himself surpassed by Theodorus, another teacher of oratory, he devoted his time to writing orations for others. He wrote more than 200, some say 400 orations, but only 223, however, were regarded as genuine. His style is applauded as a perfect example of the simple Attic eloquence. Only 34 of his orations have come down to our times. They have been published in various collections of the Attic orators; among the best separate editions of them are those by Baiter and Sauppe (1850); Cobet (1863); Thalheim (1901). Consult Jebb, 'Attic Orators' (Vol I, 1880).

LYSICRATES, lī-sĭk'rạ-tēz, **Monument of**, located in Athens; one of the earliest examples of Corinthian architecture. It was dedicated 334 B.C. to Dionysus, by Lysicrates, as a trophy for winning the Dionysian games. The monument, which was built in the form of a round temple, was surmounted by a bronze tripod and stood on a cubical base 13 feet high. The building on account of its shape was popularly known as the "Lantern of Demosthenes."

LYSIMACHIA. See LOOSESTRIFE.

LYSIMACHUS, lī-sĭm'ạ-kŭs, general and one of the diadochoi of Alexander the Great: b. Pella, Thessaly, 361 B.C.; d. near Corus, 281 B.C. He was a low-born Macedonian of great physical strength and courage. On the death of Alexander, 323 B.C., Thrace fell to the share of Lysimachus, who became also satrap of Macedonia in 286. The murder of his son Agathocles, a great favorite of the people, at the instigation of his Egyptian wife, Arsinoe, provoked a revolt in Asia; Seleucus, satrap of Syria, took up the cause of the widow of Agathocles, Lysandra, and Lysimachus was killed in the battle near Corus which ensued. He founded a city on the Hellespont, named after him Lysimachi.

LYSIMETER (a rain gauge) from two Greek words, *lysis*, dissolving, and *metron*, measure, an invention for collecting and measuring the rain that percolates through the soil; and also for the study of the composition of drainage water. The lysimeter is a watertight box (or cylinder), enclosing a definite area to a given depth and provided with a bottom arranged so that the percolating water that has drained through the soil may be drawn off and measured. This box is sunk into the soil to a level with its top. Sometimes the lysimeter is placed in a pit dug for the purpose and filled with the soil removed from the pit. Usually the conditions of the soil in the lysimeter are like those of the soil outside. Lysimeters are variously made. In some cases a trench has been dug in the soil and perforated iron plates are inserted to support the mass, with a zinc funnel to collect the drainage water and conduct it to a receptacle. Although lysimeters cannot represent accurately the conditions of the natural soil, they are valuable for comparative scientific studies on percolation, drainage and the processes of vitrification in soils. The best work with lysimeters has been done by Stockbridge at the Agricultural College, Amherst, Mass.; Sturtevant, Babcock and Goff at the Agricultural Experiment Station, Geneva, N. Y.; and Lyon at Cornell University. In other countries the leading experimenters are: England, by Lawes, Gilbert and Warrington at Rothamsted; France, by Dehérain at Grignon; Germany, by Gerlash at Bromberg; in Hawaii, by Eckert; and Moscow, by Klucharov. Consult Stockbridge, 'Investigations in Rainfall, Percolation and Evaporation' (Boston 1879); Gilbert, 'Observations on Rainfall, Percolation and Evaporation' (in 'Rothamsted Memoirs,' Vol. VII, London 1890); Dehérain, 'Les coux de drainage des terres cultives' (Paris 1893); Cameron, F. K., 'The Rôle of the Lysimeter in Soil Solution Studies' (in Eighth International Congress of Applied Chemistry Proceedings, Vol. XV, 1912); and New York State Experiment Station Reports, 1882, 1887, 1888 and 1890.

LYSIPPUS, lī-sĭp'ŭs, Greek sculptor who flourished in Sicyon between 360 and 316 B.C. Alexander the Great would permit no one but Apelles to paint his portrait, and no one but Lysippus to make his statue. Lysippus was first a smith and afterward devoted himself to sculpture, adopting the canon of Polycletes, as exemplified in that artist's 'Doryphorus.' This canon, or standard of beauty, presents the human form with the head smaller and the limbs longer and slenderer than in life. His statues were wrought with much greater ideal beauty than those of his predecessors. They were almost all, if not all, in bronze, and he is said to have left behind him some 1,500 works. Several of his more celebrated statues were those of Alexander, the most noted of which represented the Macedonian hero bearing a lance. This was considered as a sort of companion to the picture of Apelles, in which Alexander was seen, like a second Zeus, launching a thunderbolt. Among his principal ideal works are the colossal 'Zeus' at Tarentum; 'Phœbus Apollo in his four horse Chariot' at Rhodes; the bronze statue of 'Opportunity' at the entrance of a temple in Sicyon, of which several copies are extant; the colossal bronze statue of 'Hercules' at Tarentum and the famous 'Athlete,' of which the 'Apoxyomenus' of the Vatican is a copy.

LYSOL, a brown, oily liquid, having an odor resembling creosote. It is prepared from tar oil by saponification; is a useful antiseptic for the hands in a 1 or 2 per cent solution, and is chiefly used in obstetrical operations.

LYSTRA, lĭs'trạ, Asia Minor, a village of importance in ancient Lycaonia between Cappadocia and Phrygia. Lystra was a Roman colony and the place where Saint Paul healed the impotent man and was, with Saint Barnabas, worshipped as a god (‹Acts,› xiv). The actual site is a low stone-strewn mound, a little beyond the village of Khatin Serai. Near it are the ruins of a small church with a spring issuing underneath. Little remains *in situ*, but in the village are many inscriptions, several of which are in Latin. An inscription found beside the mound enabled Prof. John Robert Sitlington Sterrett (1851–1914), who visited the place in 1884, to identify it with Lystra. The first bishop of Lystra is said to have been Artemas, one of the Seventy Disciples. In the graveyard of Kavak, an hour's journey from Khatin Serai, a milestone bears the inscription «Colonia Lystrensium.» Consult Ramsay, William M., ‹The Historical Geography of Asia Minor› (London 1890); id., ‹Saint Paul the Traveller› (1895); id., ‹The Cities of Saint Paul› (New York 1907); Sterrett, J. R. S., ‹Wolf Expedition to Asia Minor› (1885); id., ‹Epigraphical Journey in Asia Minor› (1888); id., ‹Leaflets from the Notebook of a Travelling Archæologist› (1889).

LYTE, Henry Francis, English Anglican clergyman and hymn writer: b. Ednam, near Kelso, Scotland, 1 June 1793; d. Nice, France, 20 Nov. 1847. He was graduated from Trinity College, Dublin, and took orders in the Anglican Church, 1815. He was curate of Lower Brixham, Devonshire, 1823–47. He published ‹Tales Illustrative of the Lord's Prayer› (1826); ‹Poems, Chiefly Religious› (1833); ‹Miscellaneous Poems› (1868); ‹Memoir of Henry Vaughan›; ‹Abide With Me›; ‹Pleasant Are Thy Courts›; ‹Jesus, I My Cross Have Taken›; and other hymns of his have become widely popular both in America and England. His ‹Miscellaneous Poems› were issued with a memoir by his daughter (London 1868).

LYTLE, lĭt'l, **William Haines,** American general and poet: b. Cincinnati, Ohio, 2 Nov. 1826; d. Chickamauga, Tenn., 20 Sept. 1863. He was graduated at Cincinnati College, studied law and practised for a short time. He served as a captain in the Mexican War, and later was a member of the Ohio legislature. During the Civil War he was colonel of the 10th Ohio Regiment and was brigadier-general of volunteers, having been promoted to that rank for gallant conduct. He was killed at the battle of Chickamauga. His best-known poem is the famous ‹Address of Antony to Cleopatra,› the opening line of which is «I am dying, Egypt, dying.» Consult ‹Poems› with ‹Memoir› by Venable (1884). No complete collection of his works was published.

LYTTELTON, New Zealand, a seaport town on the east coast of South Island, on an inlet on the northwestern side of Banks Peninsula. It is the port of Christchurch, seven miles northwest, with which it is connected by a tunnel over a mile long. Lyttelton steamers connect the railway system of South Island with Wellington in the North Island. The abrupt hills (the walls of an extinct volcano), surrounding it, rise to 1,600 feet. The harbor, protected by great artificial breakwaters, has an area of 110 acres, and is about 10 miles long. A graving dock permits vessels of 6,000 tons to land. Lyttelton is the port for the commerce of the region of the rich agricultural district of Canterbury. The town was settled in 1850 and was called Port Cooper, Port Victoria and, finally, Lyttelton. Pop. 4,392.

LYTTON, lit'ŏn, **Edward Robert Bulwer-Lytton,** Earl of, English poet and diplomatist: b. London, 8 Nov. 1831; d. Paris, 24 Nov. 1891. He was the only son of the well-known novelist, Bulwer-Lytton (q.v.). He was educated at Harrow and Bonn, and entered the diplomatic service in 1849, being appointed attaché at Washington, where his uncle, Henry Bueller, afterward Lord Dalling, was Minister. Subsequently he held diplomatic posts at Florence (1852) and other European capitals, and was secretary of legation successively at Copenhagen, Athens, Lisbon and Madrid. In 1874 he was appointed Minister at Lisbon, and was made viceroy of India by Disraeli in 1876. At a great durbar held at Delhi in 1877, he proclaimed Queen Victoria empress of India. In the great famine of 1877–78 he conducted admirably the work of relief. He adopted an aggressive policy in Afghanistan, which brought about the second Afghan War (1879). His administration was marked by notable internal reforms, such as the abolition of the inland customs, the repeal of duties on cottons and the promulgation of new civil service rules. In 1880 he was created earl of Lytton, and on the accession of the Liberals to power in that year, who were strongly opposed to his policy in Afghanistan, he sent in his resignation as viceroy. In 1887 he was appointed British Ambassador at Paris. For many years Lytton was better known as a poet than as a diplomatist, under the pseudonym of «Owen Meredith.» His published works include ‹Clytemnestra, and Other Poems› (1855); ‹The Wanderer› (1859); ‹Lucile› (1860), a story in rimed anapæstic couplets, which met with a very great popular success; ‹The Ring of Amasis› (1863); ‹Orval, or the Fool of Time,› which is the solitary representative in English of the great Polish school of mystic verse (1869); ‹Fables, in Song› (1874); ‹Speeches of Edward Lord Lytton,› with a memoir (1874); ‹The Life and Letters of Edward Bulwer, Lord Lytton› (1883, the narrative comes down only to 1832); ‹Glenaveril› (1885); ‹After Paradise› (1887); ‹King Poppy,› his best poetical work, abounding in lofty poetry and gay irony, appeared posthumously (1892). As a prose writer Lytton takes high rank. Consult the works by his daughter, Lady Betty Balfour, ‹History of Lord Lytton's Administration, 1876–1880› (London 1899); and ‹Personal and Literary Letters› (New York 1906).

LYTTON, Lord. See Bulwer-Lytton, Edward George Earle.

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